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Optimal environments for learning: The interface of psychology, architectural design and educational practice

EDUCATIONAL & CHILD PSYCHOLOGY
VOLUME 28, NUMBER 1

Guest Editors
Liz Malcolm, Phil Stringer & Chris Walker

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Guest Editorial

Liz Malcolm, Phil Stringer & Chris Walker

LEARNING THEORY has been a key plank in the development of psychology. The study of learning environments and their impact on children's achievement has focused mostly on the internal cognitive and social aspects of learning, however, there has been a steady research interest in this relationship and the interplay between various environmental factors and aspects of learning, such as attention, for many years. For example, Dewey was an early contributor to this thinking (*School and Society*, 1934. New York: Perigee). Dewey recognised the importance of the physical environment of the school 'School and Society' what the best and wisest parent wants for his own child, that must the community want for all its children. Any other ideal for our schools is narrow and unlovely; acted upon, it destroys our democracy'.

Montessori brought a focus onto the need to pay attention to space for learning. She drew attention to the need for adults to develop new ways of working with children and the importance of the physical environment upon children's learning. (Montessori, 1936. *The Secret of Childhood*. London: Longmans, Green & Co.)

Over the last 40 years Reggio Emilia, in northern Italy, has pioneered an approach to the education of young children in which each child's intellectual, emotional, social and moral potentials are carefully cultivated. The movement in Italy gives careful attention to the design of school spaces suggesting that schools of the future should be specifically designed as hospitable environments for the new styles of learning and organising of schools 'we value space because of its power to organise, promote pleasant relationships among people of different ages, create a handsome environment, provide changes, promote choice and activity and its potential for speaking all kinds of social, affective and cognitive learning.' (Edwards, Gandini & Forman (Eds.), 1998. *Lella Gandini, Educational and Caring Spaces in The Hundred Languages of Children*. Greenwich, CT: Ablex Publishing.)

Other key contributors to the debate include Fraser and Tanner. Fraser highlighted the potential effect that child and adult perceptions of their physical environment can have on educational outcomes (in Frieburg, 1999. *School climate; Measuring, Improving and Sustaining Healthy Learning Environments*. London: Routledge). Kenneth Tanner's research and work in education planning focused on understanding the design patterns in school building that influence children's achievement. He developed a seven-factor research tool with which to begin to measure the relationships (Tanner, 2000. The influence of school architecture on student achievement. *Journal of Education Administration, 38*(4).

In 2004 a major investment programme in schools in England, Building Schools for the Future (BSF), was initiated by the then Labour Government with the aim of rebuilding or refurbishing all secondary schools over a 15- to 20-year period. There were some guiding principles associated with the initiative:

> People in the locality, school staff, members of the community surrounding the school and in particular students would be consulted as partners in the development of the school design.
>
> The designs would be transformational in that the space in schools was to be designed to be used flexibly and would in over two or three decades always be fit for purpose.
>
> To improve the educational opportunities for children by transforming the

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teaching and learning facilities in schools and so build their achievements

This programme was stopped during 2010.

Whilst there has as described been much interest and research into the link between the quality of educational outcomes and the design of school buildings the actual evidence for a causal link between children's learning/educational achievement and school buildings/environments when BSF started, in 2004 was tenuous. (Samad, & Macmillan, www.eclipseresearch.co.uk/Conferencepapers/CIBW096Denmark2005Paper.pdf)

In the last decade there has been a seismic shift in the technological communication culture within which children grow. Most present school buildings continue to reflect the communication culture and pedagogical approaches of an earlier age, long corridors giving onto rectilinear classrooms. In 1964 *The Observer* newspaper ran a competition 'The school that I'd like'. This national competition invited secondary school students to generate ideas for their ideal school. The responses were collected by the children's author Edward Blishen into a book (*The School That I'd Like,* 1969, London: Penguin Books). The overwhelming sense conveyed by children's responses was for a school that took on a shape that moved away from squareness. *The Guardian* newspaper repeated this competition in 1997 with the resulting publication *The Children's Manifesto* which called for beautiful, comfortable, safe schools. It was clear that children had views about the how education should be delivered and the quality of the school buildings in which they learn.

An important element of the BSF project process involved a review with school leadership teams regarding their desired approaches to teaching given the support of new technologies and the involvement of young people in that discussion.

In order to develop this and build on the pioneering work in student participation carried out by Schoolworks on behalf of the DfE (then DfES) the 'Joinedupdesignforschools' project was created by the architect John Sorrell with two aims, one of involving students in what they most wanted to change in their schools, and the other in the course of the process to develop life skills such as problem solving, communication, teamwork, negotiation, reasoning, citizenship and self-belief. These projects have been initiated in over 60 schools and involved over 700 students. The results of the project are graphically presented in Sorrell and Sorrell, *Joinedupdesignforschools*, 2005. London: Merrell.

Irrespective of the demise of the BSF investment programme, it continues to be crucial that the environments for learning that are being created today are able to support the development of children as active learners able to take part in a world where the nature of work and the jobs in which they will be employed are still to some extent unknown.

This edition of *Educational & Child Psychology* aims to develop the discussion on optimising learning environments by presenting some recent work of psychologists and architects that address the complex relationship between the quality and design of school buildings and children's learning.

The papers develop the arguments around the key themes of: the impact of student participation in the design of their space; the importance of considering child development, additional needs and approaches to learning in school design; the impact of student perceptions of their space on their achievements and the social messages conveyed by the design and quality of educational building.

The opening paper written by Pamela Woolner argues that by taking a participatory approach, involving the school community, to the design, building and use of a new school setting it may be possible to overcome the paucity of an evidence base for effective school design and build facilities' that are appropriate for current and future uses of the school. The article considers the theoretical understandings of participation that

have been developed about school design and also discusses some of the difficulties in putting this approach into practice.

This is followed by the description of a case study outlining a small focused piece of action research involving the same author and a colleague, Sheila McCarter. The use of 'the carpet' in primary schools as a location for teaching certain subjects and delivery of instruction is ubiquitous. McCarter and Woolner asked both children and adults for their ideas about carpet based learning and teaching. The results showed a mismatch between what children think, teachers think and what actually happens. They conclude that obtaining children's views provides teachers with an opportunity to reflect upon and possibly improve their use of physical space.

In the third paper, Edgerton and colleagues from the University of the West of Scotland describe a large-scale survey undertaken with three different year groups in seven secondary schools in Scotland. The study aimed to examine student perceptions of their school environment and to identify how the perceptions relate to educational outcomes. Based on their results they confirm that there is a relationship but caution against considering school young people as a homogenous group.

In 'Space Makers or Space Cadets', Loxley, O'Leary and Minton view space not merely as the physical properties of a school but as an actively shaped element through which social order may be produced and maintained. The article describes research undertaken in a Dublin primary school with a small group of their senior students. They suggest that the results of their visual study emphasise the need to consider space and its social construction by students as a central tenet of educational and psychological research.

The fifth paper, 'Children and their development as the starting point' by authors Rigolon and Alloway, is an attempt to bring together pedagogical and architectural thinking by exploring aspects of child development and their implications for developmentally appropriate environments. The paper highlights common themes for the design of schools as a result, including variety of scale, exposure to nature and interactivity of spaces.

Autonomy or self-regulation is an important goal in children's development of successful learning approaches. In the sixth paper, Parnell and Proctor draw on participatory action research, in which the built environment and placemaking were explored as a means to support learning, in order to consider how flexibility can be understood in terms of support for children's learning. Through examples, they argue that once children are enabled to experience their learning environment as flexible, by changing it themselves, they are better able to self direct their learning.

The impact of the characteristics of the physical environment on the ability of children with additional needs to access and maximise opportunities for learning is explored further in the next two papers. 'Soundscapes' by Joan Flagg-Williams and colleagues takes a close look at the auditory environment of learning spaces and the needs of hearing impaired children. 'Kids in motion' by McLaren and colleagues, then considers the developmental needs of children with physical disabilities and how learning spaces might be reconfigured to be more inclusive of children with physical needs.

The final paper 'Built-in' provokes further thinking about the built environment, learning and the reduction of social disparities. Highlighting, for example, the social message conveyed to children and the community by the quality of school buildings and their state of repair. Durán-Narucki describes the benefits of using an ecological psychology perspective combined with socio-historical analysis to increase understanding of the role of the built environment of the school in educational achievements.

Liz Malcolm, Phil Stringer & Chris Walker

Creating individualised optimal learning environments through participatory design

Pamela Woolner

Research evidence relating to the physical learning environment is confusing and incomplete. Studies of different aspects and elements considered in isolation are difficult to integrate, and sometimes directly contradict each other. Historical examples also demonstrate the complexity of decision making in the design and building of school premises. Therefore, the evidence base is clearly inadequate for prescribing school design.

A potential solution to this problem of designing optimal learning environments lies in taking a participatory approach to the design, building and use of a new school setting. Through the involvement of the existing school community it may be possible to design premises which are appropriate to current and future uses of the school. This can be understood as enabling school users to develop understanding of their physical environment, building a relationship with the changed environment so that they feel empowered to continue to adapt and improve their physical surroundings and their use of them.

This article considers the theoretical understandings of participation that have been developed about school design and in related areas. These suggest that a participatory approach may sometimes be difficult to enact and result in compromises. The consultation requirements of current British school building and the experiences of some of those who have been involved in the school design process recently are then examined. These tend to validate the idea that a participatory approach is necessary, but is not a straightforward matter.

The impact of the physical learning environment

PHYSICAL DETAILS of school learning environments change over time, together with levels of awareness of how the setting might affect learning. An added incentive to understand and develop school premises was provided recently by building programmes in the UK (e.g. Building Schools for the Future, PricewaterhouseCoopers, 2007, 2008, 2010; Primary Capital Programme; programmes in Scotland and Wales, Estyn, 2007) and elsewhere (e.g. Australia, Ireland). Yet the challenge of providing physical environments that support educational activities and facilitate learning is not a new problem. In tackling this issue, it is, therefore, important to consider historical experiences and the disparate research evidence base, together with the developing experiences of school communities. Clearly these experiences are various and the research base is also wide-ranging, since it results from many disciplines, with differing epistemological bases and preferred methodologies (see Woolner et al., 2007a).

It might seem promising to consider the impact on learning of particular physical aspects of the environment, and there is a body of research which measures these quantitative elements and tries to relate the measurements to learning outcomes. Such research into the impact of noise, air quality and temperature suggests, perhaps unsurprisingly, that a physically inadequate environment may lead to deficits in learning, both through direct effects on cognitive processes and through interrupting activities, and distracting or annoying learners and teachers. These findings have led a number of reviews to conclude that it is

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important for schools to have good ventilation, satisfactory heating or cooling systems and acoustics which meet published guidelines (Fisher, 2001; Schneider, 2002; Earthman, 2004).

It remains unclear, however, what benefits result from improving the physical elements of the school beyond meeting these basic requirements. Earthman (2004), for instance, concluded that while inadequate school buildings cause health problems, lower student morale and contribute to poor student performance, he was not convinced that schools need necessarily be any more than adequate. Some studies that have correlated measures of the quality of the physical environment in schools with outcomes such as standardised test results, attendance or the prevalence of troubling behaviour, seem to imply a continued relationship (Tanner, 2000; Pricewaterhouse-Coopers, 2000; Duran-Narucki, 2008; Kumar et al., 2008). Yet these also suggest the complexities of the relationships involved, as well as moving away from clearly quantifiable parts of the environment and trying to score more nuanced and subjective aspects, such as building maintenance or pleasantness of outdoor space.

Within research into the measureable environmental elements, there are other problems if studies are interpreted as environmental recommendations. Although observational and experimental studies can separate physical variables to identify potential problems, it is clear that these aspects do not exist in isolation, resulting in possible interactions. For example, some suggested acoustics improvements, such as carpets or ceiling hangings, may collect dust and so worsen air quality, perhaps causing ill health and absence from school (Smedje & Norback, 2001, p.40). On the other hand, excessive background noise in classrooms is often due to open windows (Francois & Vallet, 2001, p.8) or mechanical ventilation units (Knecht et al., 2002). Recommendations for improving air quality may also conflict with teaching practices and learning aims. For example, air quality researchers Smedje and Norback (2001) argue that since irritants and allergens collect in dust, it might be advisable to avoid open shelving, but this might reduce a teacher's ability to provide an environment in which resources are readily available to independent, active learners.

This particular interaction also reveals a more intractable side to problems of designing learning environments: education involves a range of activities and relationships, which are not immutable, but rather grow and change through the understandings learners and teachers develop in light of social and cultural views of education. For example, when board schools were designed in the 19th century, a model of learning primarily through transmission of content knowledge was associated with large but high up windows, providing the necessary light but without allowing the children to be distracted from receiving messages. From the post-war period, a valuing of the learner's understanding and perspective developed, and windows were lowered so that children could see out of them.

Changes to predominant educational style during the second half of the 20th century involved some teachers in adapting their classrooms to suit their pedagogy and emerging educational ideas. Although there were earlier isolated examples of radical alteration to traditional school settings (e.g. Prestolee: Holmes, 1952), it was in the 1960s that these became more mainstream. School architects designed schools specifically to support the progressive 'child-centred' education espoused by the Plowden report (England, 1967; Mills, 1976; Saint, 1987). This period, when architects of the time collaborated with educationalists, suggests how a solution to designing an appropriate learning environment may lie in involving the users of the setting. However, the resulting change to more open plan school environments was not accompanied by a transformation in learning. The relative lack of change demonstrates some of the limita-

tions of involving users, since it has been argued that in this case collaboration with a narrow group of innovative educators, many in senior or advisory roles, did not give a realistic picture of contemporary teaching and learning practices (Cooper, 1981).

Despite this historical warning, however, the absence of simple links between setting and learning strongly suggest that any successful attempt to fit school premises to educational needs must involve the participation of the school community. It is necessary, therefore, to question how theories of participation may assist in understanding practices and so help to enact more successful collaborative design of school learning environments.

Participation in the design process

Theoretical understandings of participation

Despite differences in the perspectives of architects and educators, there is a tendency for professionals from both backgrounds to see the physical setting and the learning activities of the users as relatively or potentially separate. Environmental psychologists, however, are more inclined to see these two aspects of the environment as fundamentally interlinked. For example, they use the concept of 'affordances', which are the possibilities provided by the environment to a user with certain skills and inclinations (Clark & Uzzell, 2006; Kytta, 2006). These exist at the interface of the person and their environment, and require an understanding of the relationship between them. More concretely, Sundstrom (1987) reports findings of increased satisfaction in workplaces which were designed through user involvement with the comment that this satisfaction could be due to the involvement itself, the resulting building actually being better...or perhaps both.

There would seem to be value in both these aspects of increased satisfaction and particularly, in the interplay between the two as time goes on. The perspective offered by environmental psychology reminds us that the relationship of the user to the environment is not static, but will, or should, respond to changes in human abilities, needs and desires. The value of such an ongoing dynamic relationship, which should be enhanced by collaborative design, is suggested by the comments of many advocates of participation in the design process (e.g. Clark, 2010; Parnell et al., 2008). It also implies, however, that involvement of users needs to be active. As part of this approach, it may be useful to observe teachers and learners in action, as indeed some architects of the mid-20th century attempted (see, for example, Saint, 1987, for discussion of Denis Hall-Clarke's approach). Yet to develop the necessary relationships between setting and users, it will be important to engage users in discussions of needs and aspirations, beyond recording their existing habits. Horne-Martin argues that teachers' abilities to make good use of their space will increase through their engaging with design and architecture. She anticipates teachers becoming more confident, more inclined and able to reorganise their classrooms according to their pedagogical intentions and avoid them being 'reduced to defensive postures' in their use of space (2006, p.101).

It seems likely that impacts of participatory design on teachers should also be seen in the content and style of their teaching, not just in how they arrange their room or cope with a new building. Facilitators of participatory design surveyed by Parnell and colleagues mentioned such impact on the curriculum, both while the projects are occurring and, hopefully, afterwards. (Parnell et al., 2008, p.215). It is evidently anticipated that the impact of participatory design goes beyond altering the attitudes or behaviour of some individuals to affect the culture of the school in the longer term. This suggests how a school community might be able to continue to appreciate a redesigned space.

It might appear that this is implying a one-way learning process, where participation in design affects the school building itself and the intertwined practice of its

inhabitants, but has no impact on the architects and designers. It is important, however, for designers and architects involved with schools to continue to develop their understanding of education. Participatory design has the potential to ensure that this happens. As architect, Jeremy Till points out, 'true participation demands that the process is two-way – that the user should have the opportunity to actively transform the knowledge of the architect' (Till, 2005, p.33). It might be argued that the assumptions made in the 1970s by school architects about educational practices would have been more nuanced if they had had more direct contact with classroom teachers, students and parents. Certainly the rather formulaic design of some open-plan primary schools and the rolling out of standard designs which occurred at this time (Woolner et al., 2005; Bennett et al., 1980) do not suggest developing architectural ideas or learning from particular school settings.

It is clear, however, that collaborations of architects and educationalists are not always straightforward. Researchers and practitioners from both perspectives have discussed difficulties, and remedies for, communication problems and the tensions caused by lack of understanding of the professional knowledge of other participants. In their work considering the collaborative design of school grounds, Sheat and Beer talk of 'bridging the gap between educationists and designers' (Sheat & Beer, 1994, p.90). Parnell's interviewees 'suggested that there are issues regarding the languages used in distinct professional areas and difficulties around creating a common language dealing with design, construction and learning/pedagogy. This implies a particular roles for facilitators and challenge to be overcome before dialogue can be established' (Parnell et al., 2008, p.221). In addition to the issues described by Parnell about facilitators and a common language, research suggests a role here for more visual methods of consultation and communication. These can circumvent the need for professional vocabulary and provide something for all participants to look at, manipulate and discuss. Creating or referring to photographs and plans can be a valuable way to understand an existing physical environment as a first step to change or development (Woolner et al., 2010; Clark, 2005, 2010).

Many participatory techniques have been developed specifically to involve learners in the design process, and this desire to involve students fits with recent enthusiasm within education for 'student voice'. Educationalists working within a student voice framework see school design as another area where students should be involved (Könings et al., 2007; Flutter, 2006; Frost & Holden, 2008). Meanwhile, within architecture and design, many of the organisations and initiatives recently established as part of the new wave of school construction have particularly targeted school students, usually on the basis that they know their school and the activities which take place there, particularly intimately. Historically, school students were rarely, if ever, directly included in the design of British schools, but they are now the group who are most commonly suggested for inclusion in consultations and participatory events. This targeting appears to be supporting the involvement of students in practice, since evaluation of BSF concluded that students were participating in BSF projects (PricewaterhouseCoopers, 2007, 2008, 2010).

There is a need, however, to ensure that there is substance to student participation in school design. This involves considering both who within the student body is given the opportunity to participate and examining its purpose. There are plenty of warnings about isolated, tokenistic initiatives which can leave students feeling frustrated and cynical (e.g. Parnell et al., 2008; Matthews & Limb, 2003; Sheat & Beer, 1994). This mirrors critiques within the student voice movement which has questioned 'who is listening?' to student voices (Fielding, 2001a, p.102) and argued for the

'building of a shared dialogue' (Lodge, 2005, p.134). Yet it is clear that not every student can be involved at every stage in a design process and in discussing collaborative design of outside space, Sheat and Beer (1994) are clear that compromises are inevitable and must be approached honestly.

It also seems important not to become too focused on the inclusion of learners and so exclude other users. As discussed above, there are valid reasons for involving teachers, but school communities also include learning support personnel, technicians, administrators, catering and cleaning staff, as well as parents, governors and the wider, neighbouring community. The involvement of these people in designing school space seems important from a democratic perspective. Yet this wider participation should also contribute to overall understanding of the relationship of the environment to learning, since some effects of the physical setting will not be mediated purely by learners' perceptions and opinions. There is some evidence of a direct influence of school condition on the quality of teaching (Estyn, 2007) and environmental psychology has found evidence of problems with physical environments, with implications for learning, of which users are not properly aware (Evans & Stecker, 2004). In general, the design of a school will affect many organisational, management and teaching decisions, producing a multifaceted learning environment, with complex patterns of use, within which each user will be aware of differing aspects. Thus, if the environment provided by the school for learning is to be comprehensively understood, it seems important for all those involved to participate. Once this is accepted it becomes necessary to develop methods to facilitate the genuine participation of a range of users, who will have differing skills and confidence, but need to contribute their knowledge and experience to an overall understanding. This, of course, raises the possibility of tensions between users' perceptions and opinions, if not actual conflicts between their desires for the learning environment, an issue which will be returned to.

In understanding participation, it may be helpful to look at theories developed outside school design consultation. Within planning, practitioners and theorists have been grappling with the issue of meaningful participation for some time. Arnstein's 'ladder of citizen participation' (1969) is a typology describing how people might be involved in the planning and operation of public programmes. This views participation as ranging from 'manipulation', where ideas are imposed on users, through 'informing' and 'consultation', which can be of limited worth if done in isolation, to the genuine participation of 'partnership' and 'citizen control' (Arnstein, 1969). Hart adapted this idea of a ladder to describe how children and young people might be involved in projects of all sorts, with their participation ranging through tokenistic inclusion to genuine partnership with adults (see, for example, Hart, 1997). Working within 'student voice', Fielding has produced a categorisation of four levels of student involvement in educational research, which goes from students as data source, through their being active respondents up to students as co-researchers and, finally, researchers (Fielding, 2001b).

These conceptions of participation are extremely useful in conveying the sense that any act of participation has a level or extent, and they can clearly assist an attempt to evaluate an example of participation. Through discovering aspects of a would-be participatory exercise that reveal its intention to inform, or worse, manipulate participants, thereby placing the exercise low on a ladder of participation, it is possible to critique the exercise and suggest improvements that could move it up the ladder. An example of this use of the conception is provided by an adaptation of Arnstein's ladder to the context of designing school grounds (Sheat & Beer, 1994, p.94).

In trying to apply these levels to the context of whole school communities partic-

ipating in a process of school redesign or reorganisation, however, a major limitation becomes obvious. All three typologies of participation are designed to categorise the involvement of single particular groups of people, either citizens, children and young people or pupils and students. Although all these groupings are wide it is possible, in the appropriate context, to talk sensibly about them as single groups. In the context of understanding and improving the design of a school, however, there are a number of quite distinct groups of people. Furthermore hierarchies inherent in school structure result in power disparities between these groups. Such power disparities may be most obvious between adults and children, but also exist between adult groups. This has been pointed out by innovators and trainers who work in schools with non-teaching staff. For example, in her tellingly titled chapter, 'You're only a dinner lady!', Gil Fell describes how lunchtime supervisors are pleased, though surprised, to be involved in improvements to breaktimes since their jobs have low status and they do not feel respected by students or teachers (Fell, 1994).

These challenges of inclusiveness are worth confronting to achieve wider participation. Within the research literature on school change, taking an approach which genuinely involves the whole school is seen as vital (Thomson, 2007) and this need has also been noted in the context of BSF rebuilding (Mitchell, 2008). It is important to widen understanding of the setting by consulting a range of users, but also vital to involve these disparate groups in the development of new ways of working. Thus the validity of a participatory design process depends on who is participating and the level of that participation. It might be helpful to see this as adding another dimension to the ladder (see Woolner, 2010, p.51). The necessary integration of differing perspectives from this range of users, however, will not be easily achieved (Woolner et al., 2010). There is likely to be a compromise between completeness and practicality, as an overview is achieved.

Having considered these theoretical understandings of participation, it is now necessary, with these ideas in mind, to investigate recent practices and experiences of educational designing in the UK. These can be found in a range of sources, from newly developed tool-kits and guides to school redesign, the consultation requirements of recent school building programmes and some research into the process.

Current experience of participation in the design of learning environments

Over the past decade numerous pamphlets and books have been produced which aim to support school communities in changing their physical space (e.g. Seymour, 2001; Design Council, 2005; Sorrel, 2005; CABE, 2009). These guides and tool kits tend to be written from a design perspective, providing encouragement to those involved in education to look afresh at their physical environments, and useful ideas for activities to facilitate this process. There is always a presumption of the importance of widening participation, especially to include learners (c.f. Sorrell, 2005), but also to include people who might otherwise be overlooked. So, for example, School Works recommend the inclusion of parents, 'including those who find it difficult to get to the school' and members of the local community 'who haven't traditionally been involved with the schools' (Seymour, 2001, p.29). A criticism of these guides is that they are strong on encouragement rather than engaging with the likely difficulties and complexities. Although there are suggestions for including disparate groups of people there is less guidance on how their contrasting and perhaps sometimes conflicting, views of the school should be integrated and understood. This omission might be related to a tendency discussed elsewhere of design professionals failing to appreciate fully the particular pressures of educational circumstances (Woolner et al., 2007b).

Similar to the school design guides, official consultation requirements tend to encourage wide participation in school building work, while not detailing how this might be most successfully enacted. For example, rebuilding or refurbishment taking place through BSF should involve 'proper consultation with the staff and pupils of the school and the wider community' (DfES, 2002, p.63). This use of the word 'consultation' could, in addition, be read as suggesting a more passive, information gathering approach than that favoured by the design tool kits, which would rate quite low on the various ladders of participation discussed above. In seeming contrast to this observation, however, the education policy background to the BSF documents was one which aimed for the transformation of learning through redesigning school facilities. *Building Bulletin 95*, which set out objectives and described how these projects should proceed, stated that BSF was to be understood as part of the Government's 'major agenda for transforming secondary education' (DfES, 2002, p.3). The idea of using school design as a way to kick-start a process of educational, as well as architectural, reflection and change continued to be evident as BSF progressed. The second annual report on the progress of BSF concluded that this transformation agenda was continuing to permeate the programme: 'The guidance provided to schools…points to the importance of schools viewing BSF as a once-in-a-lifetime opportunity to transform the function of secondary schools' (PricewaterhouseCoopers, 2008, p.10).

With both official guidance and the campaigning design literature full of visionary aims, but relatively quiet on practicalities, it is interesting to consider what has been happening in practice in UK schools. Small-scale research demonstrates ways in which participation can provide opportunities for diverse members of the school community to co-construct a complex understanding of existing and proposed school environments (Woolner et al., 2010; Sharp & Blatchford, 1994). Yet it is unclear how frequently this potential for school design to engage participants collaboratively and actively with big educational ideas is realised. Parnell's investigation of participation in school design suggests that some Local Authority (LA) officers perceive BSF as an opportunity to overhaul radically the secondary education system in their areas:

> This is reflected in the names for new schools, such as 'learning centres' which are replacing secondary schools in Knowsley and in Birmingham the BSF projects are part of the council's Transforming Education Programme. (Parnell et al., 2008, p.216).

This research, however, and the formal evaluations of BSF found that ideals about educational transformation were not trickling down from the LA through school management to classroom practitioners. The second annual BSF report specifically addressed the issue of the influence of the transformation agenda and concludes that:

> LA BSF Managers have a clear message on educational transformation[…] A more mixed picture emerges…of school-level understanding…There is positive, though not unqualified, evidence about headteachers' understanding but a less encouraging picture on teacher's engagement (PricewaterhouseCoopers, 2008, p.16).

Notably, parents, the wider community and school support staff seem to have vanished altogether from these versions of education stakeholders. The BSF evaluations also found that classroom teachers and other staff tend not to be directly involved in the design processes in schools (PricewaterhouseCoopers, 2007, 2008, 2010). A survey of headteachers in BSF schools found that heads reported the involvement of themselves and their deputies but less than a fifth described a classroom based member of staff as being 'involved or likely to be involved' in the BSF process (PricewaterhouseCoopers, 2008, p.44). The reasons for this situation seem to centre, Parnell suggests, on a sense

of lack of time (Parnell et al., 2008, p.217). Mitchell concurs that time pressures are a particular problem with BSF, and argues that because of them some LA officers are scared off real engagement with educational change (Mitchell, 2008, p.245). This problem of finding time, which Fielding has argued is a more general problem of the current educational climate (Fielding 2001a, p.103), has clear implications for the participatory design of educational space, which is necessarily a complex, time-consuming process.

Thus time constraints may have limited the range of participants in recent school design and limited the extent of the participation of those who were involved. Limits to collaboration might also be set by the scarcity, as argued above, of available guidance on coping with the contradicting and conflicting views that participation in school design is likely to produce. These suggestions of limited participation are borne out in reports of school design, since the BSF evaluations report that students are being involved in the design process, but leave doubt about genuine student participation. For example, a case study is used which 'shows how the senior leadership team used a variety of activities to consult and engage pupils in a meaningful way' (PricewaterhouseCoopers, 2008, p.27), but this may imply that student involvement often consists of consultation more than active participation. Such foreshortening of student involvement could be compounded by another problem of student participation, revealed by recent research, which is that the relative lack of power of students may make their ideas particularly vulnerable to reworking to fit the agendas of others. Fairly vague ideas may be seized by architects or designers and developed into elaborate conceptions, without reference back to the originator of the idea (Woolner et al., 2007b). Although this could happen to any idea produced by a participant, it could be that the ideas of children and young people are particularly prone to this problem due to the mismatch between their lack of power in the adult world but the high status given by that adult world to their imaginations and ideas.

Concluding thoughts on the value of communication and compromise to achieving consensus

Benefits of user participation in the design process have been noted by architects and others, and can be understood as resulting from enabling people to construct shared understandings of their environments, empowering them to adapt physical aspects and their usage. This appears valuable in the educational context, but, as I have argued above, an added impetus is provided by the difficulty of arriving at an agreed definition of an optimal learning environment. Once basic needs are met, it seems that an educational environment can only be optimal by succeeding in supporting the learning, teaching and other activities which are valued by the school community.

Recent building and refurbishment work on UK schools has co-occurred with an enthusiasm for learner participation in education, as well as official and informal support for the idea of participation of learners, teachers and others in school design. This provides an opportunity to consider the impact in practice of this sort of design. Unfortunately, between the guides to good practice and the reports of success stories, there are clear gaps. Big ideas about transforming education do not get discussed at the classroom level, many potential participants, particularly from certain user groups, are not included in the school design process and there are still problems of insubstantial, tokenistic involvement. It is frequently argued that time pressures preclude genuine participation.

It seems an unavoidable conclusion, however, that if development, and therefore change, in school settings and practices is desired, this will not be achieved through policy pronouncements that fail to connect with the understandings and practices of all

members of a school community. From work on collaborative approaches to improving school breaktimes, Sharp and Blatchford (1994) reach three conclusions. These deserve wider application as understandings of participatory approaches to educational issues, which should inform practice. Firstly, it is necessary to take a holistic approach, considering all aspects of the situation: the physical space, together with the management and organisation of time, space and people. Any change must recognise and encompass all these aspects; otherwise it will be short-lived and superficial.

The second conclusion is that for attempts at change to succeed they must involve the whole school community. The authors note that the phrase 'whole school approach' is over-used but they emphasise that there is a central 'need to involve all in a meaningful dialogue about change' (Sharp & Blatchford, 1994, p.190). Notably, within BSF, facilitator John Mitchell has recently concluded from his experiences that one of the main requirements for success is 'whole school involvement' (Mitchell, 2008, pp.244–245).

Thirdly, in connection with making changes to school breaktimes, it is concluded that it is important to understand that the process of change is not straightforward. Similar conclusions can be drawn from reviews of whole school change (Thomson, 2007) and can be seen as underlying historical changes to the learning environment, such as the development of open plan schools. In the context of school design, however, it is important that this appreciation of difficulties is not invoked to explain away deficiencies but to rectify them. Appreciating the complexities of change might make attempting a participatory approach to school design seem harder, particularly if more people, and more widely divergent views, are involved.

It is, therefore, important, at this stage, to remember an earlier argument that even a genuinely participatory approach to the school environment will not be able to include every interested party at every stage in the process. As argued in the context of outdoor space in schools (Sheat & Beer, 1994), compromises are inevitable but may be achieved, through honest communication, in ways that remain true to genuine participation. The various theories and typologies of participation (e.g. Arnstein, 1969; Hart, 1997; Fielding, 2001b), the conclusions about enacting educational change and the experiences of recent school design all provide suggestions for valuable compromises. The developing history of this period of rebuilding and refurbishment work in school settings will in time show how successful these attempts have been.

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How listening to student voice can enable teachers to reflect on and adjust their use of physical space

Sheila McCarter & Pamela Woolner

The carpet as a learning space has become the received way of delivering literacy and numeracy in English primary schools, yet remains little examined either academically or professionally. Different understandings of teaching and learning have different implications for carpet-time. As carpet time is so widespread it seems important to find out how and why it is used, and how children and teachers respond to this use of space.

This research comprised a mixed-method study of carpet use in an English primary school. Government policy has stated through the Every Child Matters (ECM) agenda that the child should be at the centre of teaching and learning (DfES, 2004). This study, therefore, asked both children and adults for their ideas about carpet-based teaching and learning. Results show a mismatch between what children think, what teachers think and what actually happens. They also demonstrate the potential to overcome these contradictions: obtaining children's views on teaching and learning can enable teachers to reflect on (and improve) their use of physical space.

BEGINNING my practice as an educational psychologist (EP), I was frequently told that a child's behaviour was unacceptable, disruptive and *'S/he won't sit still on the carpet'*. I began to question why this issue was so widespread and in particular why children were being expected to sit on the carpet at all. I tried to discover both why carpet time developed and what teachers and pupils thought about it.

The research used a 'mixed methods' methodology including activity theory, semi-structured interviews and a questionnaire. The early roots of mixed-method social inquiry are found in the construct of triangulation – the use of multiple methods to enhance confidence in the validity of the findings – and this is the construct that I have used when analysing my results.

Activity Theory (AT) is a form of action research that stresses the integration of theoretical work with empirical-practical work. The core of the method is the ongoing reflections that lead to practical changes. AT is based on the work of Vygotsky who described higher psychological cognitions as being primarily social activities mediated by tools such as language (Engestrom, 1987). Thoughts and actions can be viewed as created rather than inborn and as part of larger social practices.

What we take for granted, such as the use of the carpet to deliver whole-class lessons or the topics delivered in those lessons, are all open to questioning and challenge. If the objects we study are socio-cultural creations, we do not stand outside them and watch, neither do we just use them, we co-create them as we are all part of a given society and culture. Historically, policies on teaching, learning and educational purpose underpin action within the classroom: the way that teachers are taught to teach, what they teach and the understanding of teaching by the individuals within the community of practice. Then children and teachers together co-create the 'carpet time' experience and what it means. The practice of carpet time needs to be viewed in its historical and social context and problematised. Why are carpets rather than tables used to deliver whole class lessons?

AT is an inherently interdisciplinary approach so fits well with the idea of a socially complex school as a community of

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practice. It looks for moments of change as it is through change that fundamental aspects of a process are revealed (Vygotsky, 1978).

According to activity theory (Engestrom, 1987), when common practices are questioned and the status quo challenged, change occurs. One role of an EP is to be 'an agent of change'; challenging the status quo will invite discussion about changing practice or at least add to the understanding of that practice.

Another central EP role is to discover and advocate the pupils' views and perspectives (Farrell et al., 2006) so that their views inform decision-making. The pupils' views in the present study were investigated using semi-structured interviews and a pupil-generated questionnaire developed from information gained from the interviews. This research is thus embedded in an interest in pupil empowerment and pupil voice.

Interest in pupil voice has led to educational research increasingly focusing on what children say about their learning experience (Flutter & Ruddock, 2004). Open discussions about the classrooms in which they prefer to learn reveal differences between a teacher's view of a good classroom in which to teach and a pupil's view of a good classroom in which to learn (Flutter, 2006; Woolner et al., 2007).

A relationship also exists between the school environment and learning. Studies reveal that pupils want a more 'positive' classroom environment but that teachers saw the environment to be more 'positive' than did many of their students in the same classrooms (Pointon, 2000). For pupils, the physical conditions of school can often represent a much deeper set of issues, feelings of worth, of belonging, of ownership and of being able to make a positive contribution, all linked to the five outcomes of ECM (DfES, 2004).

Changes in the classroom learning environment

Originally, in the 1960s and the 1970s, the carpet area was seen as a 'cosy' place to read books or to relax (Moyles, 1995). It was child, rather than adult, dominated (CACE, 1967). A major change in primary education and its organisation came during this period with the move away from '11-plus' selection leading to 'child-centred' curricula based on the theories of Piaget (Piaget, 1967) delivered through non-setted topic-work. Primary classrooms moved from having rows of desks to desks arranged as tables to facilitate group work.

Subsequent rejection of 'progressive, child-centred' teaching eventually led to the introduction of the National Curriculum (NC), which for the first time in England, described the content to be taught in schools (DfEE, 1988). The National Literacy (NLS) and Numeracy (NNS) Strategies were later additions to the national curriculum, not only describing what was to be taught but also how. A decade later, however, there had been almost no change in the classroom organisation: common practice (Galton et al., 1999; Turner-Bisset, 2003) still had classrooms with grouped desks and, at least for the younger children, a carpet space.

With the imposition of the NC and, especially, the NLS and NNS the carpet became the focus of whole-class instruction, as otherwise some children seated at tables are not facing the front. This resulted in children spending much longer out of their seats than before (Galton et al., 1999). The carpet space, with few exceptions, became adult dominated and controlled. For their original use carpeted areas did not need to be large as children worked at their desks for most of the day (Galton et al., 1999; Turner-Bisset, 2003) but are now often too small to comfortably accommodate a whole class.

The pedagogical basis for this change has been described by Government policy directives (Brehony, 2005; DfES, 2006). Increased whole-class interaction is being encouraged but it is arguable whether it is being achieved (Burns & Myhill, 2004; Hardman et al., 2003; Smith et al., 2004). A tension has emerged between prescribed lesson objectives and pupil-led learning (Alexander, 2004; Brehony, 2005).

It has also been suggested that teachers may not recognise the significant role of discourse and social interaction in learning (Mroz et al., 2000; English et al., 2002; Hardman et al., 2003; Alexander, 2004; Burns & Myhill, 2004; Myhill, 2006). Unfortunately, theory and practice are often difficult to reconcile in the classroom (see for example, Alexander, 2007; Galton, 2007). Galton (2007) believes that many of the claims that there have been fundamental changes in pedagogy driven by the introduction of the NC reflect changes in classroom management rather than classroom interactions.

The current move towards whole-class teaching is further encouraged by the installation of interactive white boards (IWB): they might not determine pedagogy but as cultural tools they support and suggest whole class teaching.

The study

The study investigated what children and their teachers thought about carpet time and how it relates to particular teaching and learning theories. This involved asking the adults and children why children are taught on the carpet and about conceptualisations of learning – and how these are effected or affected by the use of carpets as physical teaching places.

Throughout the study I worked within one small, rural, primary school (119 pupils, five classes, and detailed below).

Class	Girls	Boys	Totals
YR	7	8	15
Y1/2	10	14	24
Y3/4	15	10	25
Y4/5	11	18	29
Y5/6	13	13	26
Total	56	63	119

I began by collecting visual and interview data from a range of year groups and staff (YR, Y3/4, Y5/6, each with one teacher and one teaching assistant) so that a picture could be built up of adult and children's views. Semi-structured interviews with school staff and selected children took place throughout the research cycle. The verbal responses of the participants were initially scribed but later recorded digitally.

The data from children included drawings and verbal responses. To take account of any literacy or language needs, drawings and photographs were used as a means of collecting data so as to be as inclusive as possible. In addition, the older children were asked to complete cartoons showing the speech and thoughts of children working at tables or on the carpet (Wall et al., 2005). Two focus groups were convened using volunteers from Y5/6 for one and members of the school council for the second.

Working with members of the school council, a questionnaire was developed and given to all children and teaching staff in the school (see Appendix). The questionnaire was designed by the children to address the same general areas as explored within the focus groups. This facilitated the collection of different views and perspectives from staff and pupils, adding to the internal validity of the research (Somekh & Lewin, 2005).

The data from the semi-structured interviews with adults (both teachers and teaching assistants) involved verbal and written responses. The questioning took place whenever adults had time. We talked in the staff room during breaks, on playground duties, during quiet times in lessons or when we met in the corridor.

The data was examined using thematic analysis as it was gathered. This is a flexible research tool used across different qualitative methods for identifying, analysing and reporting themes or patterns within data. I used it to interrogate the data from a social constructivist viewpoint to reflect the meaning people make of their experience and the way social context affects those meanings. My thematic analysis was data-driven but inevitably, my epistemological beliefs influenced what I found.

Initially, I interrogated the data at the semantic level and found recurring words on

the questionnaire data entry grid, the interview notes or drawings by the children. I used sets of coloured highlighters to show the frequency of repeated words and expressions on the questionnaire print-off and interview data, and post-its to write down words/ideas and attach to the drawings.

I started to notice, and look for, patterns and repeated use of particular words and expressions and began clustering words together, which involved interpretation of meaning. For example, I circled phrases and words that I interpreted to represent 'passive' learning such as 'sit in silence'; 'not allowed to talk' and others representing 'active' learning such as 'talk about strategies in groups'; 'write on my whiteboard'.

Analysis involved repeated reading of the data sets and the emerging coding, and reflecting on their meanings. I began theorising about the meaning of the identified clusters. Eventually I began to collate the codes into potential themes, checking back that they tallied with the data before deciding on the final themes. I started with many clusters of words and phrases and many 'proto' themes but after many, many reviews, the clusters developed into broad, over-arching themes such as 'power', and 'theory of learning'. The themes were used, in light of existing related research, to consider the meanings given to 'being on the carpet' by adults and children.

Results

The original interviews with staff and children in YR, Y3/4 and Y5/6 combined with the results from the questionnaire give some idea how the practice of working on the carpet was viewed by adults and children and indicate some differences between their views. There were also findings from the questionnaires that reflected differences in gender and classroom situations. There were 12 questions on the questionnaire but only four are discussed in detail below: these were chosen as a sample of the children's responses to the physical space of the carpet.

Teachers in YR, Y1/2 and Y4/5 described carpet time in terms of learning, the teacher in Y5/6 described it in terms of listening and the teacher in Y3/4 described it in terms of talking. The teachers in YR and Y3/4 both also added that purpose depends on the activity. This contrasts with the children's views: YR, Y1/2, Y5/6 children described carpet time as mainly sitting and listening. Y3/4 children viewed it as being for learning and Y4/5 for talking (see Figure 1). The differences between the way each class describes carpet time are statistically significant (Fisher's exact, two-tailed, $p<0.001$), as are the differences between males and females (Fisher's exact, two-tailed, $p=0.043$)

Although 40 per cent of both boys and girls describe carpet time in terms of sitting and listening there are other differences. More girls than boys (35 per cent compared with 15 per cent) describe carpet time in terms of learning. Boys are more likely to describe carpet time in terms of talking than girls (25 per cent compared with 16 per cent).

There is a definite (89 per cent) preference expressed by children for working at tables (see Figure 3). However, children tended to use the term 'work' to represent written tasks: discussion and oral planning is considered preparation for work, not work *per se.*

The adults set the rules for carpet time, which mainly relate to control by the teacher: children are required to be quiet unless asked to speak. The children listed rules about when to talk: quiet when someone else talks and listen; hands up to talk; no speaking. They also listed rules about physical space: hands to yourself; cross legs and arms; don't lean against the wall or tables. This last is notable in relation to the children who mentioned trying to find a comfortable way of sitting on the carpet for long periods of time (see Figure 6).

Most teachers described children as usually being allowed to choose where to sit. The adults do, however, recognise the difficulties the children have seeing and hearing the teacher unless seated at the front. Carpet

Figure 1: Children's understanding of carpet time by class.

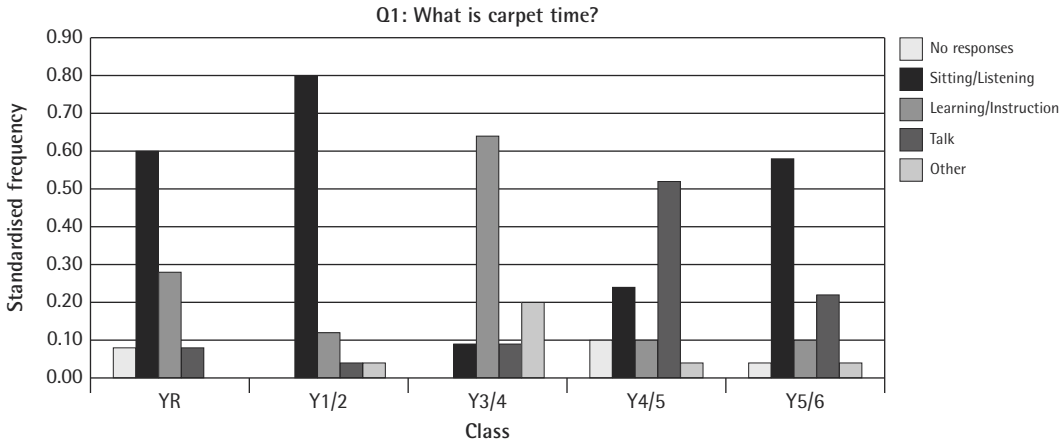


Figure 2: Children's understanding of carpet time by gender.

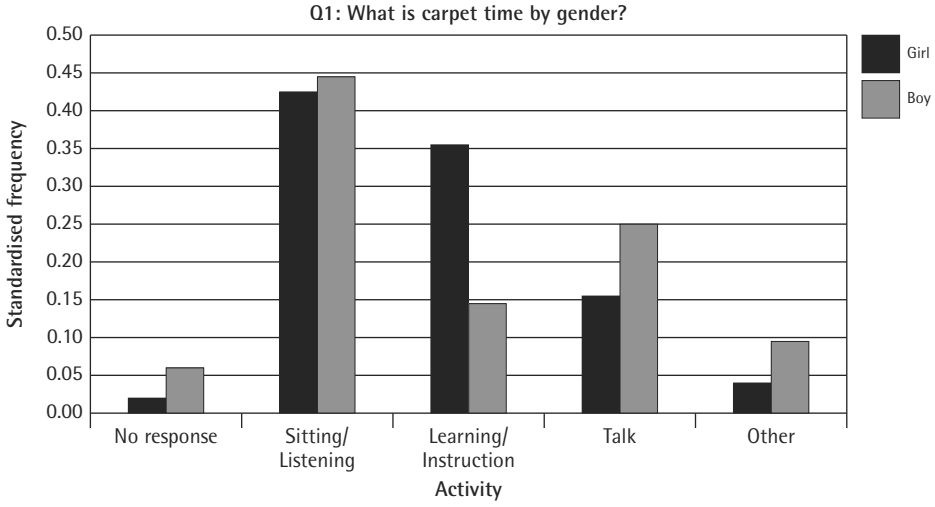


Figure 3: Where children reported working best.

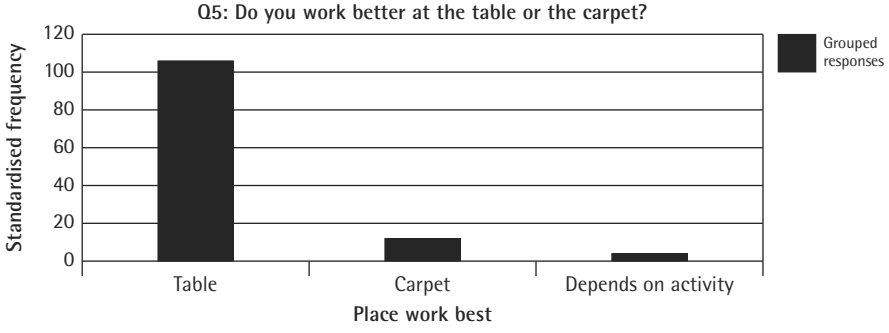


Figure 4: Reported feelings about being on the carpet by class.

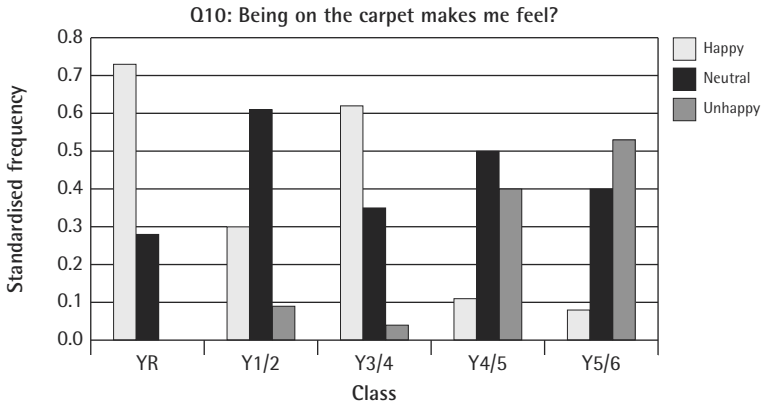


Figure 5: Reported feelings about being on the carpet by gender.

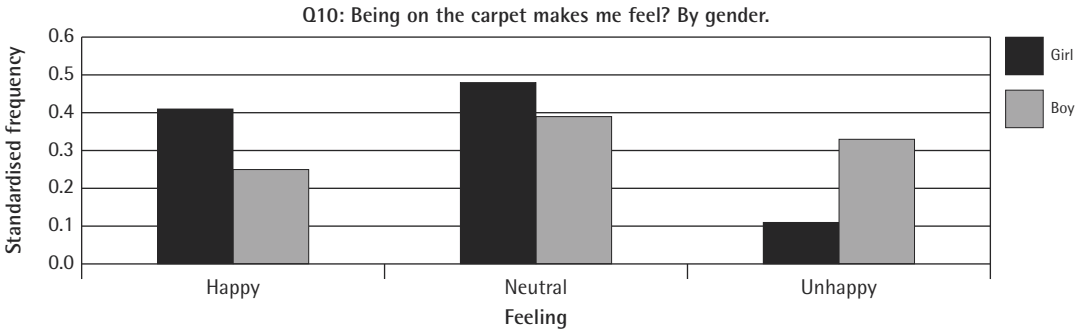
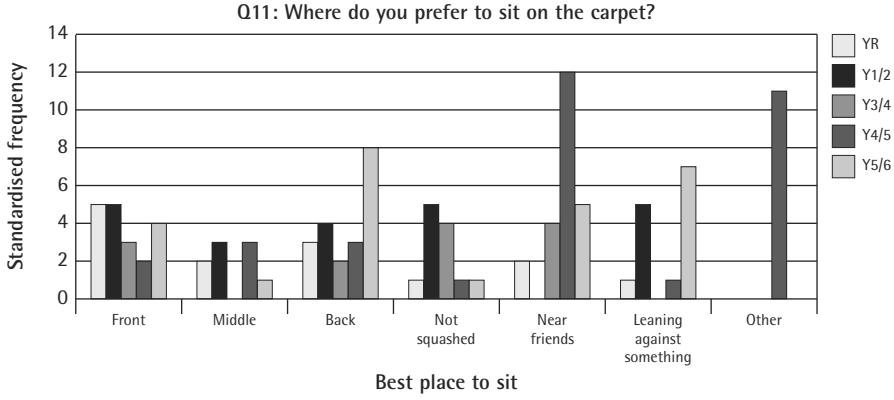


Figure 6: Best place to sit on the carpet by class.



places were usually only allocated as a way of managing behaviour, for example, to stop children talking and fiddling. The exception to this was in Y3/4 where carpet places were planned in advance and allocated depending on ability and friendship groups, and were allocated differently for different activities.

Overall, the adults in the survey were positive about their use of the carpet for teaching. The children in YR and Y3/4 were mainly happy to use the carpet for learning. The children in Y1/2 were mainly neutral, those in Y4/5 were mainly neutral or unhappy and those in Y5/6 were mainly unhappy. Without the Y3/4 responses, there would be a steady decrease in satisfaction with working on the carpet as the children got older (see Figure 4). This difference between how classes feel about sitting on the carpet is significant (chi-squared, χ^2=50.469, *df*=12 p<0.001).

The differences between the boys and girls in each class in how they felt about being on the carpet are not significant, but taking the children as a whole, there are significant differences in the male and female reporting of feelings (chi-squared, χ^2=9.856, *df*=3, p=0.020) – see Figure 5.

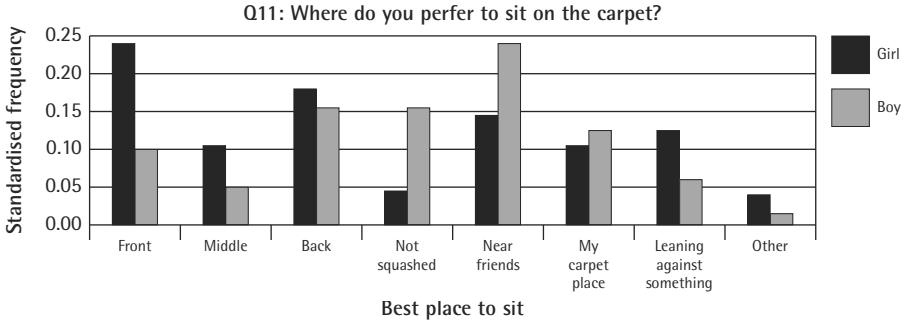
Both boys and girls are inclined to report feeling neutral towards being on the carpet but boys are more likely to report feeling unhappy and the girls more likely to report being happy.

The adults' reasons for liking carpet-time reflected their views of the lessons: they enjoy interacting with the children; they can observe children's behaviour; give support to children; children are engaged; and 'chatting' informally leads to valuable class discussions. The children's responses were not always so positive: *'my arm aches when I have to put my hand up'; 'I get a headache from the light'* (from the IWB); *'the carpet is uncomfortable'*. They do, however, have some good experiences: *'we do all sorts of fun things'*. From the adults' view point, carpet-time is *'cosy'*. The children found it less so although there were exceptions.

The children seated themselves to see or hear or be comfortable. Many preferred to sit near the front to hear well but further back to see. Wanting to sit near something to lean against was recorded several times. Some mentioned sitting near or not near friends being either supportive or distracting. Children in Y3/4 were alone in stating that their preferred place to sit was their own carpet place. This difference in view about where it's best to sit is statistically significant (Fisher's exact two-tailed, p<0.001).

To elaborate, children in YR report most often that they prefer to sit at the front on the carpet. In Y1/2 children do still want to sit near the front but they also report wanting to sit where they will not be squashed or will have something to lean

Figure 7: Where children like to sit by gender.



against. Almost half of Y3/4 class prefer an allocated place. In Y4/5 most popular is sitting near friends and Y5/6 report having wanted to sit at the back and with something to lean against, which may be a response to complaints about being told to sit up straight when sitting on the carpet.

Differences between where the boys and girls report as the best place to sit on the carpet are significant (chi-squared, χ^2=18.489 *df*=10 *p*=0.047). Girls report preferring to sit near the front more often than boys: and boys report wanting to sit near friends more often girls. Girls are also less likely to complain; they reported fewer worries about being squashed.

Discussion

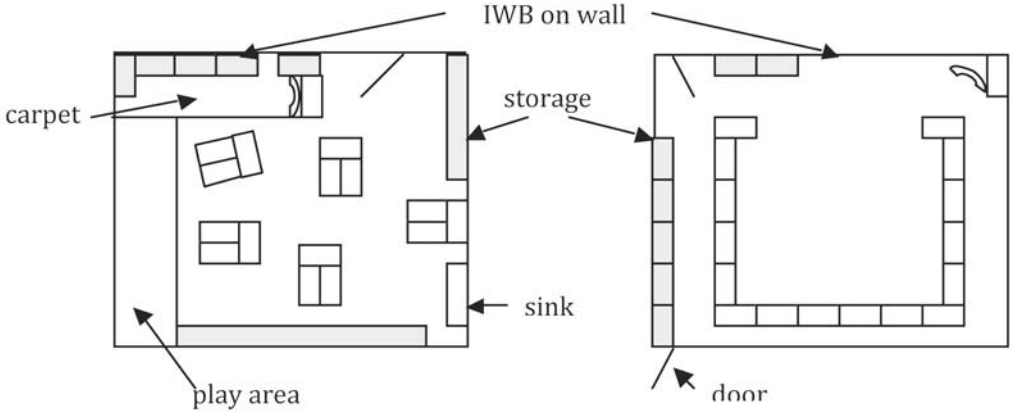
The way that teachers use the carpet space and organise the classroom reveals underlying assumptions about the way children learn. There was conflict between the teachers' intentions and actual classroom delivery. The imposition of a content-rich NC that has to be delivered 'with pace' has become another pressure on the teacher that overlays underlying beliefs about learning and teaching.

Although in theory it is possible to re-arrange the classroom for each activity, in practice this rarely happens. Once a classroom table arrangement is set up it is difficult to change without considerable upheaval, which restricts the use of space. Dedicated carpeted areas in the YR and Y1/2 classrooms imply that the carpet is expected to be used in these two classes (which is supported by Rose, 2006) but perhaps not further up the school. The carpeted area is fixed leaving the rest of the room to be set up, usually with tables arranged in groups (see Figure 8).

Mismatch between ideals and actuality

Teachers in this study (and elsewhere: Galton, 2007) appear to hold conflicting theories of the ways children learn, perhaps reflecting a pragmatic approach to theory. Alternatively, it might represent the narrative of schools: classrooms were set up with tables when the present teachers trained so they are organised in this way now. It is hard to make changes to the status quo of classroom design – especially when many curricula changes are imposed already (Brehony, 2005; Hancock & Mansfield, 2002).

Figure 8: Schematic representations of YR or Y1/2 and Y3/4 classrooms showing differing arrangements of desks and carpet areas.



YR/ Y1/2 classroom (flooring mainly vinyl)

Y3/4 classroom (all carpeted)

The children in Y3/4 described carpet time in terms of learning and their teacher in terms of talking, suggesting whole class interaction. The teachers in YR, Y1/2, and Y4/5 also describe carpet time in terms of learning but the children described sitting and listening – a transmission model. In Y5/6 both the teacher and the pupils describe 'carpet time' as *'sitting and listening'*. It appears that many children experience, or expect, learning by transmission but most teachers intend an social constructivist model.

Adults considered that the atmosphere created by gathering children close was one which was nurturing and more interactive, as well as rendering adult support more accessible. Yet teacher talk dominates carpet activities and children reported working best at the table, describing learning that is passive and transmissive.

Children's experience

A conflict exists between the transmission model of teaching that the children experience and the interactive model they are theoretically receiving. The teachers recognise the value of social interaction for learning yet find it difficult to deliver the lessons in this way.

There is also a conflict between the curriculum that is nominally differentiated for each child's needs yet delivered to the class as a whole. The child is expected to follow the whole class exposition of the lesson then go to the tables to work. Some children in this study also objected to being recalled to the carpet for the plenary when they had not finished their work. This changing of place is found by many children to be distracting and disruptive of their train of thought. They describe forgetting what they are meant to be doing by the time they get organised back at the desks. This could reflect an aspect of situated learning in that they do not generalise from what they were told on the carpet to what they need to do at the tables. According to situated learning theory, the physical and social contexts within which learning takes place are integral to learning, knowledge and action. This is why children can struggle to generalise from school to different situations. What is learnt at school serves different purposes and is embedded in different activities and practices (Lave & Wenger, 1991). A child might have difficulties generalising learning from one situation to another: from home to school; from one topic to another; from one room to another; from structured to less structured learning; or from one place in the classroom to another. If something is taught on the carpet it might not be easily related to work at the table.

Analysis by gender reveals a significant difference in the way boys and girls report their feelings. Fewer girls than boys reported being unhappy to be seated on the carpet. This may be a true reflection or an indication of gender differences in social compliance or of not wanting to hurt teachers' feelings (Burns & Myhill, 2004).

Girls tend to want to sit at the front whereas boys tend to want to be near friends or not squashed. This again seems to imply that there are gendered issues of social compliance (Burns & Myhill, 2004). This might also be a factor in gendered differences in achievement. Boys are more likely to feel negatively about their experiences on the carpet and will try to grab some control back by sitting near friends and away from the teacher so they are less squashed – perhaps making it more likely that they will disengage from the lesson.

The children describe their learning experiences as usually being controlled by others but they like times when they have more autonomy. Both adults and children commented on the most successful and most enjoyed lesson being 'show and tell'. The children seem to enjoy this because they can become involved with the lesson content and delivery: the teacher receives, rather than controls, information. The children can choose topics that interest them, rather than those determined by the NC, and appear to like this control over their learning and school space.

Overall, there is a conflict between the assumptions of the adults and the pupils' experience. The reality can be uncomfortable, works against learning and leaves little room for active participation or involvement with the lesson. This also has consequences for the inclusivity of the teacher-child interaction, as it is the teacher who initiates the hands-up response and controls who is invited to respond. Children convey the inherent power inequalities in drawings of the teacher's chair and in preferring lessons such as 'show and tell'.

Resolving tensions successfully in Y3/4

Use of the carpet can be more successful if well-planned and includes interaction and movement rather than just static activity. The Y3/4 teacher was a good example of this, planning how the carpet was to be used to deliver the lesson and being flexible in its use, even allowing the children to lie down. She regularly reflected on her practice and pupils' learning experiences. The children responded by being positive about their carpet places and lessons delivered on the carpet. The coherence in the teacher and pupils' views suggests a shared, constructivist understanding of learning.

The physical space given to the carpet area in this classroom was notable. The tables were moved back to the sides of the room in a U-shape to give a large, central, carpeted area, which made it very easy for the children to form and reform groups (see Figure 8). The teacher moved between them, monitoring discussion and gaining access to every child. In the more usual use of the carpet, the children are in a smaller space so it is harder for them to move successfully and they are more likely to remain static throughout the length of the lesson.

The children are allocated carpet spaces so that they work in groups chosen by the teacher rather than in friendship groups or with whoever they happen to sit next to. The children go back to their desks to work independently. The classroom is used flexibly for group work at tables too – children can move chairs to sit four to a table rather than just round the outside if required. There is minimum furniture shuffling involved to change the shape of the working groups but maximum flexibility (Galton et al., 1999).

This flexible approach was what made the layout so effective and popular with the class. The Y3/4 pupils and teacher developed a kind of partnership, based on co-operation and organisation, argued by Galton et al. (1999) to be fundamental to the success of classroom interactions.

Reflection and making changes to practice in Y1/2

Once sought, children's views can be surprising to the adults involved. The children in Y1/2 were very definite in their views of the use of the carpet in their class. They found the carpet space too small so they were squashed and uncomfortable; they had to sit too near to the IWB so it was difficult to see; seated at the back they could not hear; seated at the front they got discomfort in their necks.

One Y1/2 child suggested that it is easier to see the IWB from the desks – on reading this the class teacher and her teaching assistant experimented with sitting in different positions around the class and had to agree. Another child suggested that the teacher should sit on the carpet with them so that they did not have to look up so far. When the teacher mentioned this to me she also said that she had already changed her chair for one that was lower. She had also decided to hold the lesson plenary at the desks rather than moving children back to the carpet. She was quite upset and surprised by the questionnaire responses from her class and certainly had not realised how uncomfortable sitting in her carpet space was for a class of 24 pupils.

Teachers spend a great deal of time planning lessons, especially the details. They tend to focus on very small parts of the lesson, not necessarily reflecting on the whole picture, which includes the way the

room is arranged and used for each activity. It is possible, however, to modify practice in the light of feedback from the class. Although the Y1/2 teacher was unable to change the room size, she re-arranged the furniture providing more space for the children to sit. The fact that she had not been aware of the strong feelings within her class indicates how conforming and accepting children are, at least in this school. The children are generally very tolerant of their teachers' practice. This is part of the way children construct themselves and their roles as pupils.

Conclusions

I started this research by questioning why so many children found sitting on the carpet difficult. I wanted to know what children thought of the practice. I began to query whether or not using the carpet was an appropriate means of delivering lessons. By observation I found that if there is a strong commitment by the teacher for pedagogical reasons to using the carpet then the carpet works well. It can be a very flexible resource if used imaginatively: it is much easier to rearrange children on a carpet than to move desks about.

My findings are from a small data sample (one primary school) but are supported by previous research (see Galton, 2007; Alexander, 2008), which suggests that a new curriculum and pedagogy, imposed top-down, will not easily replace existing teaching methods. There is a process of adaptation, which leaves old teaching styles and patterns of interaction largely untouched (Alexander, 2004; Hancock & Mansfield, 2002). This status quo seems particularly resistant to change when it is embedded in the organisation of the physical setting.

In the school studied, there is a tension between whole class teaching and working in groups. Presently there seems to be little use being made of the grouped tables for group work (Galton, 2007). If the need for desks to be grouped is questioned, classrooms could be rearranged to give a large carpeted area (as in Y3/4) for whole class and indeed group activities with individual desks for individual work. In fact, Galton (2007) reports that more primary teachers are arranging their desks in rows rather than tables for whole-class teaching reasons – especially now much teaching is supported by the use of IWB. This suggests, however, that classroom arrangement is being led by technology rather than pedagogy.

The study reflects the tensions between espoused models of pedagogy and teaching as experienced by pupils. It allowed some of the pupils' concerns about the way they were taught to be made clear and fed back into teachers' professional reflexive practice. To change classroom practice there has to be more than just a change in the pattern of classroom organisation. Classroom discourse is culturally determined and part of the way a community of practice works (Galton, 2007; Galton et al., 2009).

This study demonstrates how a process of shared understanding, where both adults and children reflect on the use of physical space in the classroom, can facilitate physical reorganisation, begin to enable cultural change, and promote opportunities for improved teaching and learning.

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Appendix: The questionnaire developed by the children.

CLASS:.....

☐ BOY ☐ GIRL ☐ ADULT

YEAR:.....

TEACHER:.....

1. What is carpet time?.....

2. Why is carpet time important?.....

3. What do you like about it?.....

4. What do you dislike about it?.....

5. Do you work better on the carpet or the table? ☐ carpet ☐ table

6. What are the rules for carpet time?.....

7. How do you know where to sit?.....

8. What do you learn at carpet time?.....

9. What is your favourite memory of carpet time?.....

10. Sitting on the carpet makes you feel: ☐ Happy ☐ Neutral ☐ Unhappy

because:.....

11. The best place to sit at carpet time is.....

because:.....

12. Anything else that you would like to add?.....

Thank you.

Students' perceptions of their school environments and the relationship with educational outcomes

Edward Edgerton, Jim McKechnie & Sharon McEwen

In recent years there has been a substantial investment in the school estate within the UK. This investment has been accompanied by a debate on the quality of these new school buildings and the role that they may have within the education system. The view taken in this paper is that this debate is constrained by the paucity of research on school environments and the subsequent lack of an effective evidence base. In order to address this problem, this study aims to understand and measure how secondary school students perceive their physical school environments and identify how these perceptions relate to key educational outcomes. Data was collected through a combination of focus groups and a large scale survey of three different year groups of students across seven secondary schools in Scotland. The results indicated that students' perceptions of their physical school environment are related to key educational outcomes and the way in which they interact with their environment. However, the findings also indicate the danger of considering school students as a homogenous group. The implication of these findings for understanding the impact of school environments will be discussed.

IN THE UK in the last decade there has been considerable investment in new school buildings. In 2003, Building Schools for the Future (BSF) was established with a multi-million pound budget to renew all of England's 3500 state secondary schools[1]. The motivation behind this programme is to replace existing buildings that are no longer considered fit for purpose. However, the rhetoric which has accompanied new school buildings implies that the new school environments will in and of themselves contribute to educational outcomes (CABE, 2007). In Scotland where a similar investment programme has taken place it is argued that the new school environments should provide schools that '…encourage pupils personal and social development, and gives every child and young person the best possible start to life, irrespective of background, disability or additional support needs' (Children in Scotland, 2003).

Headlines such as '£35bn revamp will produce generation of mediocre schools' (Booth, 2008) and 'School buildings a scandal claims education expert' (Naysmith, 2009) indicate that concerns are being expressed about the extent to which the goals established for these new learning environments may not be being attained. A recent report by the British Council for School Environments (BCSE) noted that approximately one-third of teachers indicated that poor school design had a negative impact on their teaching (BCSE, 2007).

We would argue that the negative responses are in part linked to debates about the methods of funding introduced for these new schools. The use of Public Private Partnerships (PPP), in the views of some commentators, has resulted in cost cutting and limited involvement of end users in the design process. However, an alternative explanation for the negative reactions to new school buildings is that the design decisions are not based upon an effective evidence base. Researchers have failed to fully explore the relationship between the school environment and its users, that is, students, teachers and the community. It has

[1] In July 2010, the newly-elected coalition Government announced that it would be axing the BSF programme.

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been noted by some bodies that this lack of research evidence makes it difficult to assess the impact of new schools (Audit Scotland, 2008).

In assessing the impact of education, researchers have tended to focus on *what* is taught or *how* it is delivered. Limited attention has been paid to *where* pupils learn. The studies which have attended to the physical environment in which school students learn have shown that the environmental aspects can have important consequences for pupils.

Maxwell and Evans (2000) assessed the impact of noise levels on school students reading and language skills. They showed that fitting noise absorbent panels to the school building had a positive impact on students learning. Higgins et al. (2005) in a comprehensive review of this type of research found that variables such as temperature, noise, light and colour influence learning outcomes. Earthman and Lemasters (1998) found evidence that school maintenance, age of the building and density were related to educational achievement.

The limitation of such research is that it fails to capture the complexity of the school environment. By assessing individual variables such as noise, we are failing to understand the school students' experience of the 'whole school' environment. David (1979) argues that to address this issue we need to assess the physical school environment from the viewpoint of the students.

Relatively few studies have responded to David's proposal. Eato and Learner (1981) considered the relationship between students' perceptions of their physical school environment, self-esteem and academic attainment. They found no support for a direct link between students' perceptions of their schools and attainment. However, they did show that how students perceived their school was related to their self-esteem, and this in turn was related to academic attainment. Their findings suggest that the relationship between students' perceptions of their school environment and educational outcomes may be complex.

The study has a number of methodological problems. For example, the researchers did not use a standardised tool to assess self-esteem, and academic attainment was assessed subjectively. Eato and Learner used a semantic differential scale to assess students' perceptions of their school environment and it could, therefore, be argued that this tool will provide limited understanding of this variable.

Talton and Simpson (1987) considered the link between students' perceptions of specific aspects of the school environment and attitudes towards science and achievement. In this study, the focus was on one specific class, namely, the biology class. As in the previous study they found no evidence of a direct relationship between perceptions of the classroom environment and attainment. However, an indirect relationship emerged. Students' perception of their classroom was related to their attitudes toward science and these attitudes were related to attainment.

This study supports the argument that students' views of their school environment may be related, albeit indirectly, to educational outcomes. The generalisability of this study's findings are limited since it focuses only on the biology class and ignores perceptions of the wider school environment. An additional concern was that the measure used to assess students' views of their class consisted of two questions and it could be argued, again, that this provides only a limited assessment of this variable.

The new school building programmes in England and Wales and Scotland has stimulated some researchers to investigate the impact changes to school environments may have on a range of domains. Edgerton and McKechnie (2004) found that students' perception of their school was related to their 'self-perception' within school and subsequent improvements to the school environment resulted in improved perceptions of their school and an increase in 'self-perceptions'. Rudd et al. (2008) found that moving to a new build school had a positive impact on a range of school student atti-

tudes. These included the desire to go to school, the feeling of pride in their school and more positive views of progressing to college.

The value of such studies is that they demonstrate that students' perceptions of their school environments may be related to a wide range of educational, social and psychological outcomes. If this is the case, then it also suggests that improvements to the school environment may directly or indirectly have a positive impact on these outcomes.

However, Edgerton et al. (2007) have argued that contemporary research in this area suffers from a number of methodological weaknesses. Firstly, there are few studies that focus on the whole school environment. There are also few studies that are based on large, representative samples. Additionally, perceptions of the school environment are rarely based on the student perspective and as such these perceptions are poorly understood. Finally, key outcome variables such as academic attainment, self-esteem and student motivation are often operationalised in a subjective and or ad hoc manner.

In this paper we seek to address a number of these methodological issues by investigating how students perceive their school environment and developing a tool to measure these perceptions; this tool will then be used to measure students' perceptions of their whole school environment. Additional information on key outcome variables will also be collected using standardised measures. Finally, data will be collected on a large sample of students from different age ranges within a number of schools.

The aims of this study are: (i) to explore and understand how students perceive their school environment; (ii) to construct a survey tool to measure how students perceive their school environment and; (iii) to examine the relationship between students' perceptions of their whole school environment and key educational outcomes.

Background to the current study

The study was conducted within a local authority in central Scotland that was in the process of replacing seven of its secondary schools with six new buildings. This study is based on data that was collected from all the schools before any building work took place and is concerned with establishing the research tool and investigating the nature of the relationships. The study is part of a larger, longitudinal study that will eventually collect data from all schools before, during and after the construction of the new schools.

Study 1: Focus Groups

In order to explore and understand how students perceived their physical school environment, a series of six focus groups were conducted across two schools involved in the school re-building programme. In both schools, focus groups were conducted with students at S1, S3 and S5 levels (approximately 12, 14 and 16 years of age, respectively). The number of participants in each year group ranged from seven to 11 participants, with a total sample of 51 students.

The focus groups lasted for one hour and followed a semi-structured protocol that was designed by the researchers. The content and themes addressed by these focus groups drew on earlier research findings (Edgerton & McKechnie, 2004) and an extensive literature review of the area.

The protocol began with an icebreaker task that required students to work in pairs and list the aspects of the physical school environment they liked or disliked; this was fed back to the group and discussed. Students were then encouraged to talk about their school environment by guiding them through a 'typical school day', for example, arrival at school, movement between classes, experiences in standard classes and practical classes, where they went at interval, use of toilets and what they did at lunchtime. Additionally, students were asked to comment on their experiences of the library facilities, assembly hall, out of school facilities and security. A closing task required participants

to work in pairs and write down what they would like in their new school in relation to aspects of the physical environment. Throughout the focus groups, a blueprint of the school was provided to assist students in their discussions, for example, to identify hot or cold rooms, bottlenecks, areas to avoid and so on.

Each focus group was recorded and a content analysis was performed. Themes relating to each aspect of the physical environment were grouped together to form categories of the school environment. To ensure inter-rater reliability, three researchers reviewed the transcriptions, themes and categories. Based on an analysis of the focus group data, 15 categories were identified; these are outlined in Table 1 along with illustrative examples of the themes within each category.

The findings from the focus groups illustrate that students adopt a holistic view of their school environment rather than simply taking a 'classroom-based' perspective. Although students discussed the different classrooms within their school, they also spent considerable time discussing a wide range of different spaces, both internal and external. In addition, these findings also demonstrate that students' provide a high degree of discrimination regarding aspects of their school environment. For example, rather than simply highlighting if the toilets were good or bad, students were able to identify a number of features relating to their overall satisfaction with the toilet facilities in their school. Finally, the focus groups identified aspects of the school environment that might not have been obvious to other stakeholders such as security, for example,

Table 1: School environment categories and themes identified from the focus groups.

Category	Themes (examples)
Arriving at school	Attractiveness of the building, entrances, meeting with friends.
Non-Practical classes	Space, flexibility, line of sight, temperature, brightness, cleanliness, ability to move around, acoustics, condition, furniture, noise.
Practical classrooms	Space, ability to move around, acoustics, line of sight, cleanliness, noise, maintenance, furniture, temperature.
Moving around/ Circulation space	Attractiveness of stairs and corridors, ability to move around, layout of the school, space.
Social space	Choice of meeting spaces, not relaxing, seating, space cleanliness.
Dining facilities	Attractiveness, space, food available, availability of places to eat, places to relax, furniture.
School grounds	Choice of meeting spaces, seating, cleanliness, space.
Indoor sports facilities	Temperature, changing facilities.
Outdoor sports facilities	Condition.
Toilets	Attractiveness, condition, location, number of toilets, facilities, i.e. toilet roll, soap, paper towels.
Assembly hall	Lighting, furniture, temperature, usage, space.
Information Technology (IT)	Availability.
Library	Facilities, for example, books, computers, usage, furniture.
Security	Storage of personal belongings, personal safety, vandalism.
Out of hours use	Availability, peer groups.

areas where some students would avoid at certain times.

As well as providing valuable information on how students perceived their school environment, the focus groups were also used to develop a questionnaire that measured students' environmental perceptions. Only categories and themes from the focus groups that related to the physical school environment were included in the questionnaire. Categories and themes relating to cleanliness, availability of IT resources and the maintenance of the building were excluded. In addition, those relating to the entrances and assembly hall were excluded as students from each year group insisted that these were unimportant to them.

Study 2: The Survey Tool

The resulting questionnaire, therefore contained 10 categories relating to the physical environment of the school; the number of questions (items) within each area varied and resulted in a total of 60 items relating to the physical environment. Students were asked to rate their school on these items using a five-point Likert scale ranging from 1 (very poor) through to 5 (very good).

In addition, the questionnaire also included a section on the frequency with which students performed a range of behaviours within the school; these behaviours were grouped into the following four categories: *Difficulties interacting with the environment* (whether students perceived difficulties with their school environment such as moving between classes or having to queue for the toilets); *Security* (student concerns about safety within the school grounds); *Negative Behaviour* (how often students performed 'negative' behaviours such as skipping class, getting into trouble, etc.); and *Engagement* (how much students 'engaged' with the school, for example, volunteering to do things, using the library outside class time, etc.).

Finally, the questionnaire also included standardised measures of global and academic self-esteem and learning goals; these were operationalised as follows. Global self-esteem was measured using Rosenberg's Global Self-Esteem Scale (1965) and Academic Self-Esteem was measured using the Intellectual and School Status sub-scale (INT), from Piers and Harris' Childrens' Self-Concept Scale (Piers & Herzberg, 2002). Learning goals were measured by the Patterns of Adaptive Learning Scale (PALS) developed by Midgley et al. (2000); this provided a score on three learning styles namely, Mastery Approach, Performance Approach and Performance Avoidance.

As well as the questionnaire data, the Local Authority also provided data on academic performance for the S5 students as validated by the Scottish Qualification Authority (SQA). Students are awarded a band between 1 and 7 for each subject (with 1 being the highest band). To calculate a global score for students' academic performance, the bands achieved for each module were multiplied by the appropriate value to reflect the level of difficulty as indicated by the Scottish Credit Qualification Framework.

The questionnaire was administered in all seven schools and the number of participants was: S1 (N=781), S3 (N=978) and S5 (N=397). These figures represented a response rate of 88 per cent, 85.7 per cent and 59.7 per cent respectively.

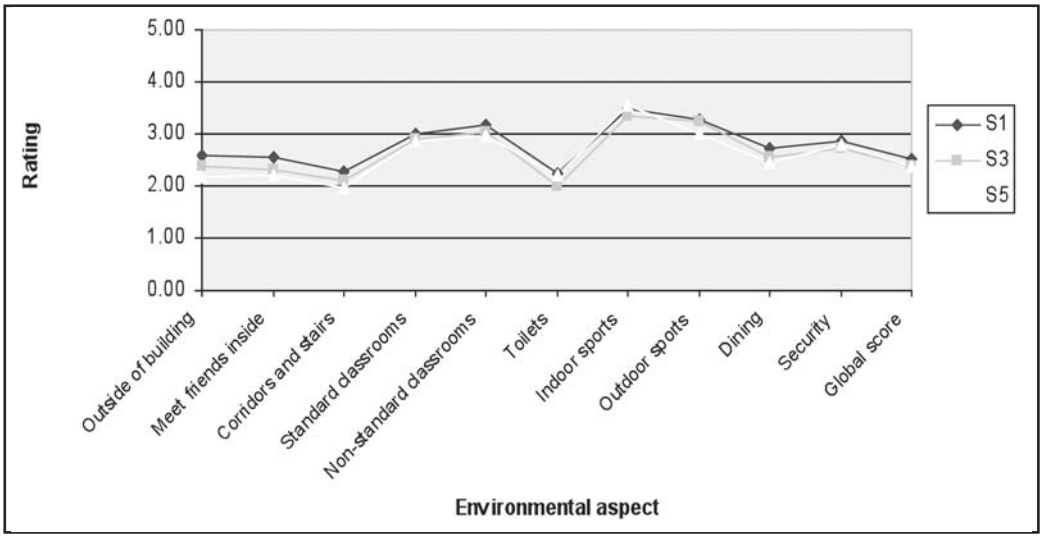
Students' perceptions across all seven schools are presented in Table 2 for each student year group. The rating of each environmental aspect could range from 1=very poor to 5=very good.

These results indicate a degree of consensus among the student year groups on their perceptions of their school environment (Figure 1). The most positively perceived aspects were the sports facilities and the least positively perceived aspects were the corridors and stairs, places to meet friends inside the school and the toilets. The S1 students' perceptions of their school environment were generally higher than the S3 and S5 students.

Table 2: Students' perceptions (ratings) of their school environment.

Environmental Aspect	S1	S3	S5
Attractiveness of the outside of the building	2.58	2.38	2.18
Places to meet friends inside the school	2.54	2.32	2.19
Corridors and stairs	2.28	2.11	1.98
Standard classrooms	2.99	2.90	2.87
Non-standard classrooms	3.16	3.03	2.97
Toilets	2.25	2.01	2.20
Indoor sports facilities	3.49	3.35	3.57
Outdoor sports facilities	3.28	3.23	3.02
Dining facilities	2.72	2.56	2.45
Security	2.86	2.73	2.78
Global score	2.52	2.38	2.36

Figure 1: S1, S3 and S5 students' mean ratings of their physical school environment.



The next part of the analysis focuses on the relationship between students' perceptions of their physical school environment and the key outcome variables. This analysis is done separately for each of the three student year groups and is based on correlating each of the 10 aspects of the school environment (plus the overall global perception) with each of the nine outcome variables. All analyses are based on a 0.01 significance level.

Table 3 indicates how each of the outcome variables related to S1 students' perceptions of the physical environment.

From Table 3, we can see that the outcome variables most often associated with S1 students' perceptions of the physical school environment are 'difficulties interacting with the environment' and 'security', that is more positive perceptions of the school environment are associated with *fewer* difficulties interacting with the environment

Table 3: The relationship between S1 student perceptions of their physical environment and outcome variables.

	Attractiveness (outside)	Attractiveness (inside)	Corridors and stairs	Standard classrooms	Non-standard classrooms	Toilets	Indoor sports	Outdoor sports	Dining hall	Security	Global perception score
Engagement				✓	✓		✓	✓		✓	✓
Negative Behaviours				✓	✓			✓		✓	✓
Difficulties interacting with environment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Security	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mastery Approach				✓	✓		✓	✓		✓	✓
Performance Approach							✓	✓			
Performance Avoidance							✓				
Academic self-esteem				✓	✓	✓	✓	✓		✓	✓
Global self-esteem				✓	✓		✓	✓		✓	✓

and *fewer* concerns about security. Other outcome variables that had a large number of significant correlations with the physical school environment were: academic self-esteem, 'engagement', global self-esteem, mastery approach and 'negative behaviours'. All of these correlations were positive with the exception of 'negative behaviours' (which had a negative correlation). This indicates that more positive perceptions of the physical school environment are associated with higher academic and global self-esteem, greater engagement with school, more mastery approach to learning and fewer 'negative behaviours'.

Table 4 indicates how each of the outcome variables related to S3 students' perceptions of the physical environment.

From Table 4, we can see that the outcome variables most often associated with S3 students' perceptions of the physical school environment are 'difficulties interacting with the environment' and 'security', that is more positive perceptions of the school environment are associated with *fewer* difficulties interacting with the environment and *fewer* concerns about security. Other outcome variables that had a large number of significant correlations with the physical school environment were: 'engagement',

Table 4: The relationship between S3 student perceptions of their physical environment and outcome variables.

	Attractiveness (outside)	Attractiveness (inside)	Corridors and stairs	Standard classrooms	Non-standard classrooms	Toilets	Indoor sports	Outdoor sports	Dining hall	Security	Global perception score
Engagement	✓	✓		✓	✓		✓	✓		✓	✓
Negative Behaviours	✓			✓	✓	✓		✓		✓	✓
Difficulties interacting with environment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Security	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mastery Approach	✓			✓	✓		✓	✓		✓	✓
Performance Approach											
Performance Avoidance											
Academic self-esteem				✓	✓					✓	✓
Global self-esteem	✓			✓	✓		✓	✓			✓

global self-esteem, mastery approach and 'negative behaviours'. All of these correlations were positive with the exception of 'negative behaviours' (which had a negative correlation). This again indicates that more positive perceptions of the physical school environment are associated with higher global self-esteem, greater engagement with school, more mastery approach to learning and fewer 'negative behaviours'.

Table 5 indicates how each of the outcome variables related to S5 students' perceptions of the physical environment.

From Table 5, we can see that the outcome variables most often associated with S5 students' perceptions of the physical school environment are 'difficulties interacting with the environment' and 'security' i.e. more positive perceptions of the school environment are associated with *fewer* difficulties interacting with the environment and *fewer* concerns about security. The only other outcome variable that had significant correlations with the physical school environment was 'engagement' which was positively correlated with students' perceptions. In this case this indicates that more positive perceptions of the physical school environment are associated with greater 'engagement' with school.

Table 5: The relationship between S5 student perceptions of their physical environment and outcome variables.

	Attractiveness (outside)	Attractiveness (inside)	Corridors and stairs	Standard classrooms	Non-standard classrooms	Toilets	Indoor sports	Outdoor sports	Dining hall	Security	Global perception score
Engagement				✓	✓		✓				✓
Negative Behaviours								✓			
Difficulties interacting with environment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Security	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mastery Approach											
Performance Approach											
Performance Avoidance											
Academic self-esteem											
Global self-esteem					✓						

Overall there were fewer significant associations between the outcome variables and students' perceptions of the physical school environment for S5 students compared with S1 and S3 students.

Discussion

The findings from the focus groups clearly demonstrate that when students reflect on the physical environment of their school, they do so from a holistic point of view rather than 'classroom-centric' perspective. In this respect, students' perceptions of their schools differ from other stakeholders in the education system. Environmental aspects such as well-designed social and circulation spaces, good quality toilet and dining facilities and an environment that enhances feelings of safety and security, are all important environmental considerations for secondary school students. The focus groups also allowed students to add detail by allowing them to identify and discuss the individual elements that contributed to these environmental aspects. For example, as well as being attractive and having enough space and furniture, good quality social spaces should be varied or flexible enough to facilitate different activities such as relaxing alone, having privacy to be with your friends, etc.

As well as being valuable in their own right, the findings from the focus groups also allowed for the development of a 'student-centred' questionnaire to measure students perceptions of their physical school environment. This approach addresses the weaknesses of previous research on school environments and concurs with the argument that there is a need to measure and understand the physical school environment from the perspective of the students (David, 1979).

When this questionnaire was administered to S1, S3 and S5 students in all seven schools, a number of clear and interesting trends emerged. Firstly, there was a high level of agreement amongst the different student year groups concerning what they perceived as being the best and worst features of their school environments. All three year groups perceived the sports facilities the most positively whilst the most negatively perceived aspects were the toilets and the corridor and stairs.

As well as this general high level of agreement, it was also noticeable that S1 students' perceptions were generally the most positive and S5 students' perceptions were generally the most negative. One explanation for this is that the S1 students may be experiencing a 'halo effect'. When these students begin secondary school they encounter a new physical and social environment with new teachers, new students, new subjects and new styles of teaching. It could be the case that these S1 students perceive these changes positively and that this in turn influenced their evaluations of the physical school environment overall.

However, previous research suggests that the transition from primary to secondary school is an unnerving time for students and is associated with greater cognitive, social and emotional changes (Lucey & Reay, 2000; Slater & McKeown, 2004). In spite of this, Chedzoy and Burden (2005) found that whilst students in the UK reported anxiety about the transition to high school, by the end of the first year students reported 'more satisfaction at the more complex organisation structure of having lots of different teachers for different curriculum subjects' (Chedzoy & Burden, 2005). Thus, it appears that first year students' apprehensions about secondary school diminish once they settle into their new environment and as the students in this study were surveyed at the end of their first academic year it is plausible that they began to perceive their environment more positively and experience less anxiety and more satisfaction.

The differences between the year groups in their perceptions of their school environment may also be indicative of students' experience within the school and the different needs that they may have. For example, the S3 and S5 students have greater choice of subjects, which may place more demands on their environment in terms of the facilities needed and movement throughout the school building if these subjects are taught at opposite ends of the building. With this in mind, it is possible that the lower perceptions of the physical school environment by S3 (and particularly S5) students may be attributed to a greater discrepancy between their needs and the physical school environment. This supports previous research which highlights that different user needs influence how the physical environment is perceived (Maxwell, 2000; Ornstein, 1997).

The relationship between students' perceptions of their school environments and key outcome variables highlighted a number of important findings. Across all schools, students' perceptions of their school environment were strongly related to difficulties interacting with the environment and concerns about security, that is the more positively students perceived their school environment the less likely they were to experience difficulties interacting with their environment and the less likely they were to have concerns about security. Since these two outcome variables are clearly concerned with the physical environment, the results again support the validity of the research questionnaire.

The other outcome variables that were most often related to perceptions of the school environment were engaging behaviours, negative behaviours and self-esteem. Yet again, these relationships were most commonly found for S1 and S3 students. At the same time however, actual levels of 'engagement', 'negative behaviours' and self-esteem (both academic and global) remain at a similar level across the three year groups. This is a positive finding and suggests that the S5 students, despite being in an environment that they dislike, cope by adapting. It is possible that as students progress through school they place less importance on the physical school environment (as evidenced by the number of correlations in Tables 3 to 5) and place more importance on other aspects such as teaching style, future aspirations and peer group interactions. These alternative variables become more importance in defining self-esteem. Alves-Martins et al. (2002) note a similar adaptive behaviour in students who perform poorly in school. They assert that in order to preserve their self-esteem students can re-evaluate the domains that are important to them and shift the importance from academic pursuits to other domains that they are successful in (for example, peer interactions).

The final point to note about the relationship between students' perceptions of the physical school environment and the outcome variables is that the environmental aspects that have the highest number of significant correlations are the standard and non-standard classrooms, the sports facilities and security.

Overall, the results of this study have demonstrated the validity of understanding and assessing the physical school environment from the perspective of students. Although there are broad trends across the different year groups of students in their perception of their schools, there are also important differences which may reflect the different needs of different groups of students; secondary school students are not one, homogenous group.

Additionally, the results clearly demonstrate that the way in which students perceive their school environments is related to important educational outcomes. Generally speaking, students that have more positive perceptions of their school environment are less likely to have difficulties interacting with the school environment, have fewer concerns about security, are less likely to perform negative behaviours, are more likely to 'engage' with the school and have higher academic and global self-esteem. These relationships are stronger for S1 and S3 students than S5 students.

This study has developed a 'student-centred' tool for measuring how students perceive the physical environment of their secondary school. This tool provides a valuable insight into understanding what students like and dislike about their school environments and how these perceptions can vary between different cohorts of students. By accurately measuring students perceptions of their school buildings we were able to demonstrate how these perceptions are related to key educational outcomes. In order to improve our understanding of the role of the school environment in the teaching and learning experiences of young people, it would be valuable for future research to investigate these relationships in more detail. What is clear from this study, is that the physical environment in which teaching and learning takes place is important and needs to be considered as a key factor in the educational process.

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Space Makers or Space Cadets? Exploring children's perceptions of space and place in the context of a Dublin primary school

Andrew Loxley, Barry O'Leary & Stephen James Minton

This paper discusses two interconnected themes: (1) the variegated role of space in primary school architecture; and (2), the perception of this space as a lived phenomenon from the perspective of pupils. In this context, space is not seen as being synonymous with the physical properties of a school (although this does exert an influence), but as an 'active ingredient' through which a particular social order is produced and sustained. Echoing the work of Lefebvre's (1991) triadic conceptualisation of space, Markus's (1993) meshing of architecture and power (via Foucault, 1991a, 1991b), certain extensions of ecological/ecosystemic theories of child and adolescent development (Bronfenbrenner, 1979; Deboutte et al., 2006; Deklerck et al., 2003), and Burke and Grosvenor (2008) on pedagogic practices and space, we argue that space, far from being a Cartesian 'bucket' to contain social action, is a fundamental dimension of any teaching and learning environment. More specifically, what we refer to as 'space' is structured (i.e. produced and organised) by the social actions of agents (pupils, teachers, parents and administrative staff) within the school environment, which is refracted back onto these agents and, in turn, structures them. By applying a predominately visually-orientated methodological approach, namely graphic elicitation and participant-generated images, the study focused on a cohort of 17 pupils in a senior primary school in Dublin. The discussion of the data explored how the pupils categorised space(s) in the primary school environment, and how their act of 'structuring the structure' generated complex and competing meanings. The results of this visual study indicated that it was pupils who maintained the power to appropriate spatial and social relations, creating possibilities of performance, repetition and regulation, contest and conflict within the school environment. Discussions of these results directed learning towards conceptions of space as a subject of ineluctable importance in educational and psychological research.

Keywords: *Space; children; primary schools; Ireland; visual methods.*

Introduction: Making Space for Space – some conceptual bricks and mortar

JOHN URRY (1995) argues that with a few notable exceptions, much sociological research and theorising has largely been aspatial. That is, as a discipline, it has tended to view space as a 'backdrop' or 'container' for human action, rather than treat it is a critical 'ingredient' within any social nexus. Whilst, for example, ecological and ecosystemic theories of child and adolescent development (e.g. Bronfenbrenner, 1979) have been influential in representing space both as a context in which social relationships are formed and impact on the developing self and how that internalised self relates to the larger social and physical environment, psychologists have, for the most part, proceeded as *aspatially* as their sociological counterparts.

However, a more lucrative theoretical domain for exploring the spatial dimension of education and schooling is to be found within the discipline of geography. As an entrée into thinking about space, it is apposite to start with some observations from three geographers (David Harvey, Doreen Massey and Henri Lefebvre) concerning its

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status and role as a conceptual 'tool'.[1] In drawing out a common theme which underpins all three perspectives outlined below, it is their emphasis on space as inextricably linked to not only our sense of self and community, but as a phenomenon which is constructed within and through our social practices. More specifically, the construction of space is not only to do with the built (as well as non-built) environment (a relatively obvious dimension), but also the affective and cognitive (how we attach meaning to space) and power (concerning the appropriation and control of space).

To borrow Bourdieu's (1984) notion, we structure space as knowing and active agents, but in turn space structures us. In this sense, we do not have an absolute capacity to do what we want with space; rather it acts as a constraint, and imposes boundaries, quite literally and metaphorically, on our ideas and actions. This we will return to below in the discussion of the data generated for this paper. This sense of constructed space is echoed in David Harvey's observation that:

> Our sense of who we are, where we belong and what our obligations encompass – in short our *identity* – is profoundly affected by our sense of location in space and time. In other words, we broadly locate our identity in terms of space (I belong here) and time (this is my *biography*, my *history*). (Harvey, 1992 [2001], p.124)

Harvey's (1992) position sees space as being firmly bound up with identity (cultural, political, economic, gender, ethnicity and so on), which also implies an embodied, as well as concomitant phenomenological and existential relationship with our sense of location. As Cresswell (2004) notes, Harvey is trying to engender a relative degree of 'permanence in the flow of space and time' through our attempt to create what Tuan (1977) poetically describes as a 'pause'. Our sense of space is as much mediated to us via our senses (smell, vision, taste, touch), kinesis and proxemics and our culturally derived spatial frameworks (see Tuan, 1977, and Lawson, 2001). The converse of this pause, is a sense of dislocation and the melange of emotions (fear, angst, exhilaration, anxiety) that we experience in attempting to physically and cognitively orientate ourselves in new or unknown spaces we may find ourselves in; the first day at school, a new city, a new place of work, a taboo place in a familiar town, lost on a hillside walk and so on.

The second observation comes from Massey (2005) who, in exploring the twin affects of post-structuralism and post-modernism on contemporary geography, argues that space, for far too long has been seen as the poor relation to that of time. Massey's argument is relatively simple; space, as a significant explanatory and theoretical concept within the social sciences, has been passed over or just given quite literally a supporting role. For Massey, it is time, largely in the form of history, which is given the theoretical task of binding together the social world. Models (and with it metaphors), whether at a macro- or micro-level which speak of flux, fluidity, complexity, chaos, change, evolution, revolution, dialectics, causality (the temporal gold-standard) prioritise process, that is temporality over that of spatiality. However, she argues that 'if times unfolds as change then space unfolds

[1] For human geographers in particular, there has been an analytical debate over the terms space and place since the 1970s (see, for example, Cresswell, 2004). The former is seen more as a traditional social science abstraction, akin to that of class, gender, the nation state, etc., whereas the latter (whilst no less an abstraction), is seen to function in a more phenomenological manner. That is, place is used as a term to denote a lived experience or in the human geographers parlance a sense of 'rootedness'. As argued by Tuan (1977), 'if we think of space as that which allows movement, then place is a pause; each pause in movement makes it possible for location to be transformed into place.' Whilst acknowledging this debate, we have in this paper chosen to use space to stand for both an abstract and phenomenological constructs which we hope for the reader does not cause too much theoretical dissonance.

as interaction…space is the social dimension…it is the sphere of continuous production through practices of material engagement' (p.62). This she also refers to as 'simultaneity', which captures the notion that heterogeneity of activities can be occurring at the same time in and across a multitude of different spaces. When put in the context of the school, this observation conveys a high degree of ecological and empirical validity.

However, in more general terms (and similar to Lefebvre, whom we discuss below), Massey is taking issue with our received doxa that space is fixed, static, absolute and above all, conceptually (apart from the issue of measurement) unproblematic. Rather, space (as well as time) is, as Sanders (2008) argues, 'relational', in that it has no realist ontological status or 'exists in itself' (i.e. it exists as a categorical entity independent of our consciousness of it; see Schmid, 2008, p.28; O'Grady, 2002), but only has existence within 'the processes that define them'. For instance, the physical area which we label 'school space' only takes on this persona, so to speak, in conjunction with a set of institutional relationships (teachers, parents, pupils, cleaners etc) which are underpinned by a corpus of knowledge (pedagogical, organisational, managerial, pastoral, etc.) which provides for a set of rules and resources as to not only how this space should be used, but how it is to be defined and by whom. This post-structuralist rendering of space, opens up to contestation, fundamental questions of what constitutes space: how it is represented, how it is appropriated and exchanged, and how it is demarcated. Central to this is arguably the role of power and how this is mobilised for example within the school, to make and legitimise these claims about space. This ongoing conflict not only over the physical attributes of space, but also possession (and with it use) and definition, is very evident in the data we present in this paper.

The third observation is by the French Marxist geographer Lefebvre, from his seminal 1974 [1991] work, *The Production of Space*. Like Massey, Lefebvre is attempting to rescue and rehabilitate space from the conceptual wilderness (no pun intended), not through its absence or marginality in the social sciences, but through the way it is conceived. To this end, Lefebvre has argued that we need to shift away from merely conceptualising it as a phenomenon which is a fixed and finite (i.e. absolute) area between two (or more) points which is amenable to measurement. As argued by Lefebvre, it became 'a space (or a representation of a space) long used as a space of *reference*' (Lefebvre, p.285, original emphasis). In other words, space was conceptualised as a necessary condition for the conduct of social relations, but as a phenomena, it was just treated as a place in which these social processes played themselves out. Put in simple terms, who we interact with takes on greater conceptual importance than where we interact with them. In taking this a stage further, Lefebvre developed a triadic conception of space which consists of:

1. Social practices (perceived space) – this refers to: (a) a range of activities that concern the physical organisation and control of space (ownership of property, development of infrastructure, demarcation and the creation of regions, zones, nation states); and (b), the norms and expectations associated with daily life, i.e. how to behave and act in any given space (the shopping centre, the school, the theatre, the home, the bathroom, the kitchen and so on), but also: (i) how it can/should be used; (ii) who can use/occupy this space; and (iii) relationships between users and non-users. As such, it is through these practices that certain forms of relationships are valorised and legitimised.

2. Systems of representation of space (conceived space) – this is concerned with space as an abstract entity and ultimately as an object of conceptualisation and theorisation. In this context space is provenance of the expert

(the engineer, the architect, the town planner etc), the scientist, mathematicians, the geographer and geologist underpinned by a discourse about space which are highly codified and esoteric.

3. Spaces of representation (lived space) – how space is experienced individually and collectively (inhabitants and users) through the translation and transformation of its symbols [material and non-material] (buildings, communication technology, transportation networks and so on).

For Lefebvre it is essential that the three elements of the triad are treated as a whole and not analytically separated out. As Lefebvre poetically puts it, our experience of space is 'essentially qualitative…fluid and dynamic'. For instance, the university does not just exist as an idea (a *conceived space* of policy, pedagogic theory, production and storage of knowledge, research strategies, etc.) but it is also as a physical 'thing', brought into existence via this 'plan' which we experience (in both a cognitive and sensory way *(perceived space and lived space)*. Although this university space (including what Lefebvre refers to as the textures of space, its physicality and rules governing its use), in most instances precedes us and constrains our activities within it, it does not ultimately determine what we do, as we can also act on space, changing it as we move through it.

The organisation of space: The school as a spatial order?

In picking up on Harvey's idea concerning the fluidity of space, time and identity, this next section provides an outline of a framework borrowed from Halford (2008), as well as drawing on some of the work of Markus (1993), both of whom try to make sense of space as a lived experience, but more importantly, as a socially-organised phenomenon. One such expression of this social order is through the different kinds of organisations in which we encounter: schools, hospitals, shops, airports, and so on. However, our experience of these organisations is as much spatial as they are relational and temporal, and to a large degree embodied. For instance, our experience of a crowded airport is as much physical as it is cognitive. For Markus and Halford respectively, space is not treated as a passive container, but as per Lefebvre, as an active 'resource' in the mobilisation of power and the management of meaning and experience. In the work of Thomas Markus (1993) and in context of schooling in particular (see Burke & Grosvenor, 2008), this is a highly significant premise. To draw on Foucault's (1991b) line of reasoning, space as an articulation of power/knowledge can be both productive and oppressive. The school as an institution is as much about the production and reproduction of a given social order (i.e. oppressive) as it is about forming and constructing a certain kind of human being, for example within Irish schools one that is literate, numerate, employable, law-abiding and culturally aware (i.e. productive). Though in Foucault's scheme of things, what constitutes production and oppression is historically contingent.

The work of Halford is more concerned with the space of the workplace (mainly commercial) rather than the school; however, she provides a number of insights concerning organisations which are reasonably transferable to schools, given that they do share a number of similar organisational characteristics. The most obvious of these characteristics is that schools are also workplaces for both children and adults; but, as argued by Burke and Grosvenor (2003), 'like other buildings, schools are the products of social behaviour…they should not be viewed merely as a capsule, but as designed spaces that in their materiality, project a system of values' (p.2). Hence, it is important to view schools not as mere containers for action, but active components in the moral and cultural formation and moulding of certain kind of human identity.

Markus (1993), in his historical survey of 17th and 18th century public architecture describes this meshing of values and school

buildings as being charged with a mission to affect character 'formation'. This is succinctly captured in the work of one of the key Victorian school architects E.R. Robson (1874/1974), who remarked that in the 'fitting-up of school houses…arrangements [need to be made which are] best for the health, comfort, and effective teaching of children and setting forth how the different parts of the building should fit together to form one harmonious whole' (p.15). Such was Robson's scrupulous attention to detail, that he even provided instructions and schematics for the design of furniture, lavatories, flooring and so forth.[2]

1. Bodily control

Bodily control is probably the most obvious perspective through which spatial power can be explored. Halford (2008) argues that power, and with it control, can be exercised through the use of spatial regimes which are an amalgam of the physical fabric of a building (rooms, corridors, playgrounds, offices, libraries, etc.) and the managerial strategies adopted (policy and regulations around for example allocation of office space, health and safety, movement around the building, access, task delegation, etc.). Power is generally seen as being hierarchical in its application, but exercised in a multiplicity of ways to control and determine not only the physical movement of individuals (i.e. who can go where – canteens, offices, classrooms, playgrounds, laboratories, etc.), as well as who (teachers, hourly paid, staff, lecturers, students, etc.) can do what (teach, mend the windows, clean up the rubbish, use the playground, etc.) in certain spaces (classrooms, playgrounds, etc.). This distribution of bodies in space (Foucault, 1991a) around the physical infrastructure via task, status and role also exerts an ideological affect, as it functions to reinforce (formally and informally) networks of social relations as well as the value orientation of the organisation.

It is through these 'micro-interactions' (as Collins (2004), characterises them) that we, quite literally, come to know our 'place'. However, as noted by Felsted, Jewson and Walters (2005), through the emergence of flatter hierarchies and distributed leadership, facilitated by changes in technology, there is a further shift that is discernable in office work which has created a more mobile class of professional and managerial workers. Whilst this may give rise to a greater sense of physical (and with it spatial) autonomy, they go on to argue that it has the effect of blurring the distinction between the private (home) and public spaces (the office) as work and non-work time and space become intermingled. However, this is not a homogenous effect across all white collar workers, as certain kinds of work practices are reserved for what are deemed to be high-skill and high-trust roles. As Baldry's (1997) insightful history of office work reminds us, for many so-called low-skill and low-trust workers, technology and its organisation (whether in the form of the typewriter or the computer), rather than being liberating, can become just another fetter used to control and monitor their behaviour and productivity.

It can be argued that, embedded within these various spaces as per Lefebvre, are societal norms and expectations around what constitutes legitimate (and illegitimate) modes of behaviour. In relation to schooling, the control and distribution of bodies (teachers, pupils, parents etc.) in both space and time is tightly circumscribed, hierarchical and seen as necessary for the supposed efficient and effective realisation of organisational goals. The school timetable can be seen as a critical instrument in this process, as it brings together in the form of temporal and spatial prescriptions the whole gamut of teaching and learning activities in one managerial tool (for more on time, see Hargreaves, 1994). As well as this formal

[2] For a late 20th century take on school architecture, see, for example, Dudek (2000), where attention is also paid to the fine grained elements of teaching and learning.

mechanism of control, the distribution of bodies is also organised informally via that great euphemism 'the hidden curriculum'; that collection of unwritten and at times unspoken rules that govern thought and action within the school.

2. Symbolic space

The notion that space can operate in the symbolic realm is a profoundly critical one. At one level we have what Markus (1993) refers to as 'buildings as texts', in which they can be read as semiotic signs. As Burke and Grosvenor (2008) suggest 'the sight of a school…results in many different narratives depending on the point of view of the onlooker' (p.7). A particular configuration of walls, doors, glass, and type of materials not only gives form to what we recognise as a primary school, but also constructs the function, i.e. the use of space and practices within it (they tend to be physically small, light and airy, for children aged between 5 and 11, apply a distinctive curriculum and teaching and learning methods, movement around the school is minimal, etc.). As such, we draw on our own experiences and culturally derived knowledge of physical structures in order to construct a grammar and syntax of buildings, in order to make sense of what they stand for. Hence, this narrative/text metaphor can imply that a space and/or building can be read in a number of ways, which in turn are contingent upon the social position of the reader.

Markus further notes that the labels we use to demarcate one kind of building from another designate both spatial arrangements and function. The 'school', the 'hospital', the 'prison', the 'university' are at the same time places (physical entities) and institutions (sets of social relations) that are fused together into a meaningful whole. In short, the architecture and aesthetics of buildings and spaces can operate as a form of ideological shorthand for the underlying value system which they are both a product of and emblem for (Halford, 2004). However, functions are not necessarily static and inextricably tied to form, as they can shift and change over time. For instance, once sacred places such as churches in Oxford can become trendy cocktail bars or private houses; gasometers in Dublin are recreated into hotels and then into private apartments; seminaries are transformed into secular colleges – perhaps a subtle change in function, but a change nonetheless. In addition, we are also confronted by a plethora of spatial symbols whose meanings may be more subtle and diffuse as well as ambiguous. The physical form of the building is only part of the symbolic narrative which is constructed: what it does, who uses it, who can not use it, when it was built, who designed it, where it is located, how the space inside and outside are allocated, and so on, are all elements of this story.

3. The spatial self

The last way of thinking about organisations and space is, as Halford (2004) argues, more focused on the notion of agency and how individuals and groups experience and make sense of the places in which they (willingly or not) find themselves. This is intended to have a more of a phenomenological dimension and an ethnographic sensibility than the first two frameworks, as it shifts away from the formal tenets of organisational and managerial strategies and stratagems, or the semiotics, of space and onto the consequences of such regimes onto to who they are directed. Additionally, we need to see the way in which factors such as power, gender, ethnicity, disability and social class form part of the geopolitics of the school and the workplace. This is an important observation, as it implies that we need to be careful not to over-determine the effect and/or influence of space on individuals or groups, nor to be too quick to presume an isomorphic, as well as complete extension of control and surveillance, which is either imposed and exerted through the meshing of managerial (e.g. relational) practices and spatial configurations/organisation.

Hence, it is not always possible to simply predict *a priori* the effects of any given spatial arrangements on its intended recipients or users. Ostensibly neutral spaces such as school staffrooms are fraught with micro-politics. For new teachers, staffrooms can be spaces more difficult to navigate than the demands of being in the classroom. They are complex spaces whose rules and rituals are learnt more through trial and error than through any formal induction or handbook for new teachers in terms of both the relationships between staff (who talks to whom, who doesn't talk to whom), who controls what space (who or which groups sit where), who controls the flow, volume and forms of information (the notice board), what cups and mugs you can and can't use. They are also exclusionary and exclusive spaces, prohibited territory for students and non-teachers alike, which reinforces in a spatial manner existing hierarchies and statuses both within and outside of the teaching staff.

An approach towards thinking about the spatial self, in relation to space in schools, is provided by Deboutte et al. (2006). In describing a conceptual and working model that has been much influenced by Bronfenbrenner's (1979) ecological theory of child development, Deklerck, Deboutte & Depuydt (2003) stated that pedagogy should:

> '…start from the experiential world of the child…children want to learn, and a school must offer the right stimulation…children are able to ethically flourish if given the chance to reflect upon deeply human experiences that present themselves in everyday life' (p. 322).

This approach is known as *'verbondenheid'*, a Dutch/Flemish word that is rendered *'linkedness'* in English. This conceptual position holds that so-called 'delinquency' and non-respectful behaviour at school are non-accidental, and 'in broad terms, involve the interaction between person-related factors (both endogenous and exogenous) on the one hand, and context-related factors on the other' (Deboutte et al., 2006, p.10). The approach to such problems takes into account five levels – the personal, the interaction, the material, the broad social environment and the 'natural living' environment levels (Deboutte et al., 2006). The argument is that *'de-linq-ency'* is in general '…always the expression of the lack of a *link* between the offender and (one or more dimensions of) the victimised environment' (Deklerck, Deboutte & Depuydt, 2003, p. 321; italics ours) and '…consequently, re-linking is the logical answer' (Deboutte et al., 2006, p.11). As a practical way of working, the 'Linkedness' concept has been applied in the generation of resources and procedures that have been used in whole-school anti-bullying/anti-violence programmes Flanders-wide and, increasingly, other European countries (Deboutte et al., 2006). In such programmes, the goals of applying the 'Linkedness' concept have been the creation of a positive school ethos and environment, and the reduction of non-respectful and violent behaviour in schools, through co-operative endeavours involving the entire school team (Deboutte et al., 2006).

The study

In taking some of the ideas discussed above and exploring them in an empirical context, the data considered in this part of the paper is derived from an exploratory case study which was undertaken in a boys' primary school located within inner city Dublin – see Figure 1.

The participants who volunteered to take part in the study were a class of 17 boys aged between 12 and 13 years of age. The focus of the study at this early stage was to gain an insight into two main questions:

1. How do the seniors boys in the school perceive space and articulate (visual, textually and orally) their sense of space; and
2. What kind of social practices and strategies emerge within this space(s)?

Figure 1.

The research methods

The use of visual methodologies in social science and educational research, whilst still a 'marginal pursuit', has nonetheless developed a fairly well established framework over the past 20 years, and with it, protocols for undertaking this genre of empirical work. According to Prosser and Loxley (2008), there are three main modes of visual data construction which can be either used individually or blended into a single study:

1. *Researcher-generated* – images (still, moving, graphical) which are constructed by a researcher specifically for a study;
2. *Researcher-found* – images, as well as artefacts, which have been found or 'discovered', which are considered to be relevant to the study. Typically, little is known about the context of creation (e.g. who made it, why it is was made, when it was made); and,
3. *Participant-generated* – images or artefacts which are created by research participants specifically for the study they are involved in. Additionally, this can include images which have been found or 'discovered' by a participant, which are considered relevant to the study.

For this study, the participant-generated mode only was used, which involved asking the pupils to undertake three related tasks:

1. Participant-generated spatial inventories (a form of graphical concept mapping);
2. Participant-generated graphical images of an ideal school; and,
3. Participant-generated photographic images of spaces within the school.

The rationale for using these three interlinked methods was to try and capture in the form of text, graphics and photographic images, a range of different ways in which the pupils not only conceptualised space, but represented it. In short, Worth's (1980) notion of 'records of a culture' (documents made by members of a culture) as opposed to 'records about a culture' (data generated by outsiders) was worked with in the attempt to capture, however incomplete, the participants' spatial constructions and spatial practices. In addition, visual methods were an approach that the pupils were familiar with.

Doing research in and through art had been previously explored in class and the pupils had experienced visual art as an apposite form of representation. This paper presented images as a cogent, direct form of expression which appealed to the pupils, rather than linguistic expositions. If the school were to be redesigned, it would be important to know how space is used, by whom and to what end.

The first task was designed to provide an initial 'way in' to their understanding of school space, through both textual and graphical representations. The initial task in this research consisted of pupils articulating their ideas about the different spaces in the school in written words and in diagrams. An added intention, whilst trying not to be overly directive, was to try to encourage the pupils' consideration beyond the usual ripostes of yard, corridor and classroom. The second task was that of an image of their ideal school. This was an attempt to get the pupils to proffer a normative construction of space which would function as a contrast to their reported experience of space in the school (see Burke & Grosvenor, 2003). The third task shifted the emphasis back onto pupils' experience of the school, but encouraged them to represent it via photographic images. Commonly attached to participant image generation is the use of verbal elicitation, usually in the form of semi-structured interviews. Here, the intention was to use the images in two main ways: (1) to dialogically explore the meanings embedded in the data (and this applies to both researcher and participant); and, (2), to explore the intentions as to why any given image was generated. The latter was particularly helpful as it permitted gaining a degree of purchase on what motivated a participant to generate one particular (and especially photographic) image, as opposed to another, within the parameters set by the researcher.

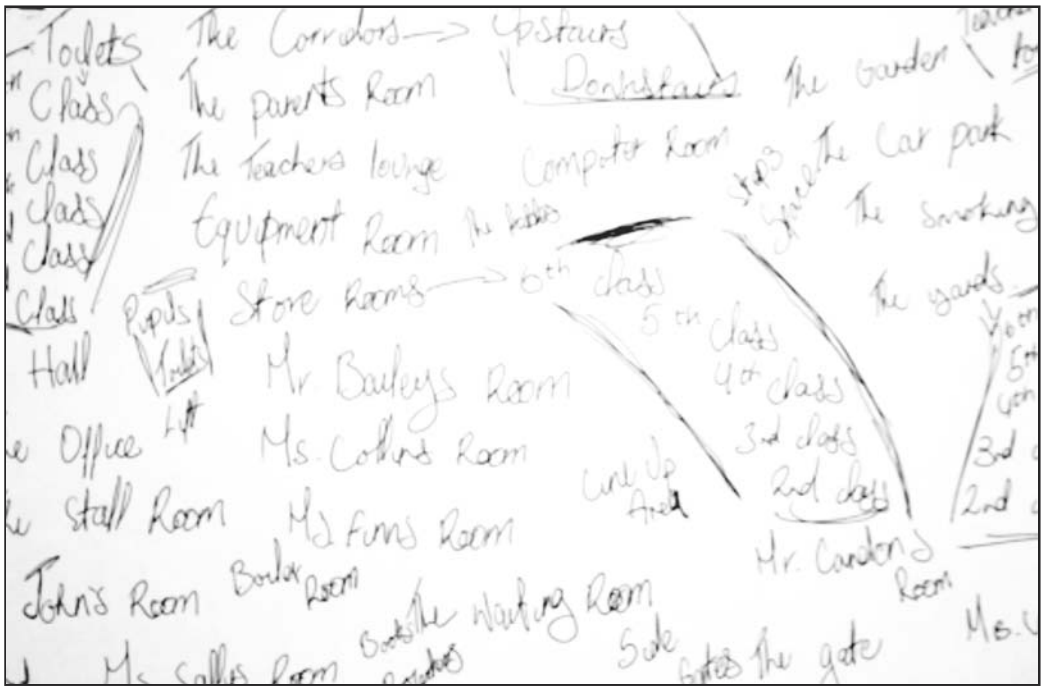
Views from the data

The first task generated an interesting range of data and as an initial exploratory exercise the pupils indicated a variegated role for space in what is quite a small school. More specifically, eight pupils identified more than 30 separate spaces, while the remaining nine indicated over 20 different spaces within the school environment. Figure 2 shows an example of what the pupils produced.

These textual representations indicated the different perspectives pupils harbour as they move through the school. A number of pupils listed various spaces in a diagrammatic but haphazard manner but a greater number of pupils (N=10) undertook this task in a private, imaged way. One boy remarked 'I pictured myself walking through the school' while another said 'I didn't think there was gonna be half of it, when you look around there's loads though'. The pupils told us that they, as an act of imagination, retraced the steps that are taken from the school gate in the morning, to their usual place in the school yard, through the line up area as the morning bell rings, passing the office, up the stairs and along the corridor to the classroom. The inventory compiled in this manner indicated an awareness of moving through space and the different spaces that accompany this short, but daily trip. Significantly, the classrooms along the corridor were listed in order in which they are passed and were named according the teacher of class year in each. These spaces were seen to have a very clear identity, particularly as the pupils did not have a vested interest in the space beyond the door of each class. Reflecting on the inventory of each pupil, the space appropriate to the classroom was uniformly assigned a title, the class year, or the teacher associated with that classroom.

The next part of the task was to ask the pupils to give these named spaces a graphical identity. The pupils were asked to map their inventory onto a pre-printed architectural plan of the school – essentially, a basic outline of the school. This method was intended to allow the pupils to represent the space in a way that fostered a more systematic mapping of space, in contrast to the initial more open

Figure 2.



end part of this task, as our intention was to encourage the pupils to invest each space with meaning for a particular purpose at a particular time (see Figure 3).

For the second task, pupils were asked to draw their ideal school. This exercise served as an invitation to pupils to design their perfect school, implicitly illustrating a number of favourite spaces and granting precedence to spaces where pupils feel comfortable and enjoy a sense of ownership. It also highlighted the difference between a mapped inventory of the actual school and an imagined school, as the comparative analysis indicated which spaces the pupils produced and felt comfortable in and those they did not, through the title, scale or by virtue of their absence in the illustration (see Figure 4).

For the last task, the pupils were invited to photograph spaces in the school which might be structured within the school environment and refracted back on them: see Figures 5 and 6 (the library and the playground).

This final exercise was a visualisation of structured space through the use of reflexive photo-participation. The pupils using digital cameras recorded space that they liked, or did not like, space where they felt a sense of ownership, and spaces that they felt were typical and spaces that were unusual for a school. The boys were then interviewed about the visual data they produced. The generation of these images encouraged each of the pupils to categorise space they produce in the primary school environment (i.e. 'structure the structure'), as well as provide complex and competing meanings in their narratives about their spatial experiences. In turn, this process of graphic elicitation allowed us to explore dialogically their understanding of the purpose and structure of each chosen space and any relevant linkages between them.

Making sense of the data

In this next section we will present two of the man themes which emerged from the data. The first point to note, is it that although

Figure 3.

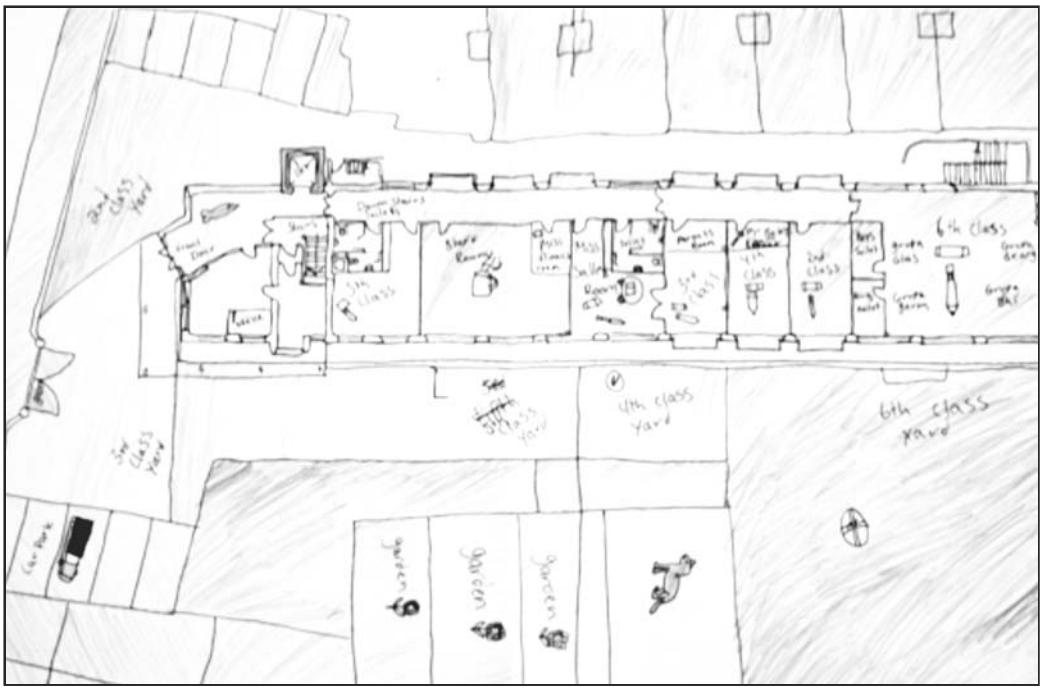


Figure 4.

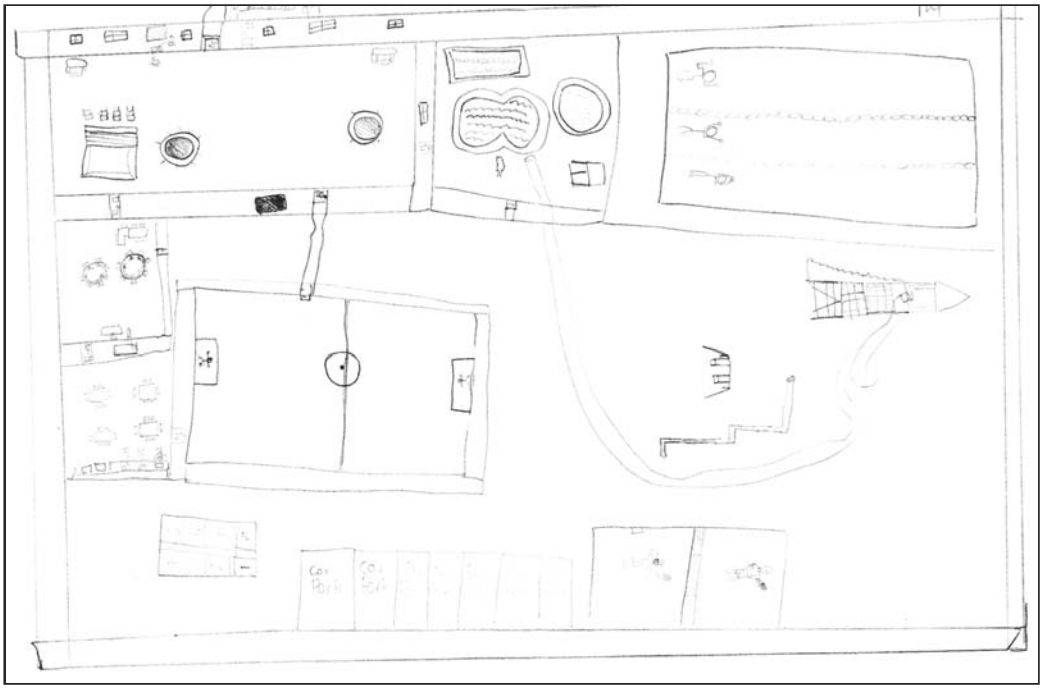


Figure 5.

Figure 6.

there was an expression of territoriality as a source of power in the active organisation and segmentation of space which was manifest through the older pupils exerting their school sanctioned sense of spatial 'entitlement' in the sixth class playground, this was surprisingly not the dominant finding. Rather, there were two other and unexpected themes which emerged from the data which we discuss below. Firstly, there was an active interest by the pupils in what can be classified as privileged space. As Thomson (2005) argues this is space which is novel, organised and with entry being allowed by adult invitation only. Within the interviews the pupils, perhaps unsurprisingly, demonstrated an interest in these spaces and, more specifically, the wish to appropriate it and actively (re)organise it according to their personal volition. Secondly, and as a corollary of the first theme, pupils advanced the idea of modelling adult space. Adult space such as the staff room or the office was considered a space of value, and an analogous space, appropriate to what they saw as their (i.e. pupils') needs, was argued for.

Thirdly, the pupils expressed a desire to colonise spaces which were not essentially within their own domain, i.e. classrooms and the yard but which they occupied as part of their daily life in the school. Although it can be argued that the classroom is ultimately the teacher's space, it is nonetheless a domain which from the pupils' experience and perspective is open to negotiation over for example, where to sit, how to position furniture, what can be displayed on the walls and so on. This aspiration for control was more pronounced in the yard, and like the classroom, it is nominally an adult space, and it organised according to adult perception and policy. However, in practice, it is an ambiguous space, shared between the overlapping worlds of adult policy to manage the yard and the desire of the pupils to colonise this space, which was patently expressed, readily annexed, and interestingly in collusion with teaching staff.

1. Privileged space

In the school there are a number of areas which can be classified as 'privileged spaces'; these include the computer room, the library and the roof-top garden (see Figure 7). These spaces were initially organised by members of staff who controlled both access and defined what activities could be undertaken in them. Then, as a shift in policy, these spaces were offered to the pupils as a privileged space. In short, this space is open to pupils as part of an unwritten reward system. For example, access to the computer room could be determined by their classroom performance or behaviour. However, it is clear that once pupils gain access to these spaces, they try to exert a sense of ownership and attempt to re-create the space which is at variance to the original school policy. In the inventory of school spaces, as well as in the photographs, each pupil invariably noted and took images of the computer room, library and roof garden.

Nevertheless, these privileged spaces offered each member of the class an image of an ideal space, an alternative which was in contrast to their perceptions (and experience) of the classroom as a place of 'loads of work, stacks of work'. If the privileged space could be breached, then it could be appropriated to the individual and collective intentions of the pupils. This was noted in the number of photographs (N=10) which pupils took of the beanbags in the library and of the cushioned ground cover in the roof garden (N=8). Pupils viewed each space as somewhere for 'just chilling out and all' where you just 'read books and relax, don't do work' or a space in which they can 'play cards and all'. It is very clear that the pupils affected a 'consensus' in how the space should be perceived. The consensus here renders the production of this space practical and concrete, and the similarity of visual data indicates the wish among pupils to maintain the power and structure of such spaces.

Figure 7.

The production of space, as a space for 'chilling out' or 'relaxing in' is refracted back onto the pupils. It is their sustained efforts to denote the space in this way that perpetuates the appropriation. Spaces such as the roof garden and computer room have changed from the original and singular purpose of serving the curriculum directly. The visual data produced by the participants in this research indicate this process. The space was initially made by members of staff and school policy. Each was a space that was originally designed to assist the curriculum but now is now a space produced to entice certain behaviour or offer incentive. Within these spaces, the school offered entry if pupils behaved or performed accordingly. Once pupils have acted accordingly and entered the space, how it was constructed and named by the adults mattered little – it becomes a space for chilling out or relaxing, rather than a library space for researching projects or a roof garden to assist science studies. It is remade and reclassified as a space appropriate to the pupils' wishes. Members of staff are happy to accommodate this reappropriation (as it does not appear to be a space of conflict in any instance), and so this newly-made space serves the interest of both parties who produce the space. The structure of this space is thus perpetuated and maintained, indicating the power of pupils to appropriate space. It is an example of 'structuring the structure' that allows pupils to create the possibilities of performance, repetition and regulation within the school environment.

2. Modelling adult space

The second theme that emerged concerned the pupils' perceptions and illustrations around the function and form of each space. Whereas privileged space functions as a messy hybrid between the worlds of pupils and adults, there is in the school a category of space which is resolutely adult in form and function. The most obvious is the staffroom, which was described by the pupils as a space for adults 'to talk', 'for their break' and 'to drink coffee'. The staffroom was also seen by

one pupil as a being as a cathartic space to get away from the pupils:

> BL: Of all this spaces which do you think is the most important?
>
> *George (pupil): The Staffroom…you don't want angry teachers.*
>
> BL: Angry teachers?
>
> *George: You don't want angry teachers cause you's are moanbags…just take the staffroom away from them for a day and see what happens.*

Next to the staffroom another 'adult only zone', is the office. This was described by the pupils as the domain of 'Sharon' [school secretary] and 'the principal'. As observed by one pupil 'because there's nothing for us to do in the office…it's just work, work, work and we don't play in it.' These were resolutely adult spaces and should remain so. However, the view from the pupils was that they did not want to appropriate this actual space (staffroom or office), but instead have a space or spaces which were free from adult control or surveillance and controlled by their own rules. This idea of analogous adult space was evident in presence of a 'chill out room' in 12 drawings of ideal schools. It admits the attraction of a space such as the staff room, within the school. All pupils who were asked to photograph spaces of interest to them in the school incorporated an image of the staffroom in their visual data and commented on the space. A number of pupils noted that 'it's just for the staff to go in and eat their lunch and talk', whilst George has perceptively noted above, 'take the staffroom away from them for a day and see what happens.'

The idea of a chill-out room, proposed by 12 of the pupils, would create an equivalent space 'instead of just staying outside' at break times. At the very least, it is indicative of the desire to model adult space, to produce an autonomous space for pupils within the school. This was envisaged as a space 'for relaxing', to 'chill out', for 'reading books', to 'pick new books', to 'sit down', to 'calm down', and 'play guitar'. Typically, a number of pupils suggested such a space should be the preserve of sixth class, but space such as this would be naturally valued, and so be seen as being other than neutral. If this is the case, it becomes a designated or classified area where novel conditions might exist and where certain individuals may have access. Regardless, it is clearly modelled on adult space, and it is occupied and managed in a certain way, and the space in this area is produced in an effort to sustain this standing. This is not dissimilar to the sense of ownership that is pervasive in relation to the office and staffroom.

3. Ambiguous space

From out of the data we can also suggest a third kind of space which we have labelled 'ambiguous space'. It is other spaces, such as the yard and the general area of the hall that offer autonomy and possibilities of appropriation to pupils. The general perception by the pupils is that these spaces are not adult spaces. Yet naturally, each is a space conceived by adults to contain movement and activities in a defined spatial arrangement. Each space, from the classroom to the playground, is determined by an adult view of the pupils' spatial desires. A number of pupils, however, have determined and visualised these spaces according to their own appropriation. As such, pupils have advanced a renegotiation of these spaces, essentially indicating the continuing effort of pupils to appropriate spatial and social relations.

There is a connection here with the idea of 'modelling adult space', as part of the yard is assigned to them by school policy by virtue of their seniority, which in turn is used as a basis to exclude other pupils. Incursions on to the yard are quickly dealt with, as the intruders are informed of where they should be 'cause they ruin the game'. Indeed, this renegotiation allowed pupils create their own privileged space which others may enter or use according to their reason rather than school policy, thus imitating the adult spaces they see around them.

George: And our yard, we don't let anyone on that. That's just ours.
BL: That's just yours?
George: Yeah.
BL: And how do you think people might feel if they go down to your yard while you guys are there?
George: Just shouldn't go down to it.
BL: Why not?
George: Just shouldn't.
BL: Why not?
George: 'Cause we just tell them to get off, and if they don't we just kill them.
BL: Use that nice polite language do you? 'Please get off our yard'
George: No, just tell them. Give them orders.

However, as Thomson (2006) has observed, the energy and enthusiasm displayed by children in schoolyards may sometimes belie the levels of adult control over this space. Accordingly, she concludes that while the playground affords pupils a measure of autonomy, evidenced in territorial behaviours and intentional boundary crossing, it is ultimately 'a space conceived by adults to contain children at school' (p.76). However, the control of this space is not absolute, but is recognised as being conditional upon good behaviour as pupils know that 'they (teachers) don't say much if you're not messing, only having a little fun', that in the 'rest of the areas you have to do work but in this one you go out and play'. There is a knowing recognition that this is really controlled by the teachers and they are licensed users of this space. At work is also a strange collusion between adults and pupils which is shown quite clearly in the following quote: 'they get told to go back down to their own yard by the teacher or else the people that's playing on the yard' (Steven). Whilst teachers may not be overly welcome in this space, they can be enlisted by the pupils to support and endorse their presumed hegemony over the younger pupils. Indeed Catling (2005) has noted the enduring ability of pupils to 'find ways to circumvent the constructions or bounds placed on their use of space' (p.327).

While these pupils have limited opportunities to shape other spaces in the school, the yard is their opportunity to produce their own space. This continuous renegotiation of ambiguous spaces may not pose a fundamental challenge to the structural realities of the school environment, it is an enduring tension between relatively authorative school structures and the capacity of the pupils to act autonomously, and produce space according to their preference. It is an enduring feature that pupils will always try to structure the structure.

Concluding thoughts

James (1990, p.279) has indicated that there is an 'implicit lack of interest' in the children's view in many 'research areas and methodologies' dealing with space. There is the perception that their spatial experiences are analogous to adult perceptions or too guileless and simple to count. Whilst more recent research moves away from this perception, the data presented here indicates very clearly that pupils have an interest in the spaces of their primary school, and a clear interest in commissioning these spaces in service of their own intentions.

Firstly, there is the effort to actively engage and organise the space, rather than by stand and observe the typical patterns disgorged by school policy and adult decree. This effort and interaction is typical of the small battles and appropriation of space that mark the spaces of this Dublin primary school. In addition, to grant pupils unconditional access to all spaces within the school, as might seem the ideal, in a school charged with the ethos of equality and ownership, serves only to undermine the organisation of the school. Where pupils have full and ready access to actively organise their own space, can become a space noted by territorialisation. Or indeed the opposite can occur, a disinterest and familiarity that emanates from knowing the space can be appropriated to their suggestion at any given time. It is privileged spaces that can hold the key to sustaining pupils' interest and the structure of space.

Secondly, the interest that pupils maintain in modelling adult space and colonising ambiguous space is significant in two respects. Fundamentally, there is the sense of the collective in each of these spaces. The pupils envisaged their analogous, adult space, 'the chill out' room as a space that would be the preserve of the senior class, shared with friends within that class. Unlike an adult who may prefer an individual, personal space, pupils viewed this space and others, as collective and shared, bound up with their combined identity and concerted solicitations. A comparable effort was evident in how the space of the yard was structured. It was as unified entity that senior pupils annexed this space, in collusion with the teaching staff. Senior pupils preached as a party their right to this space and their collective right to dismiss any incursion. More importantly, the collective approach evident in the spatial practice of the pupils harmonises the three main perspectives of spatialisation in relation to the organisation, in this instance the primary school. Whether it is the call for an analogous, adult space or the colonisation of an ambiguous space in the yard, senior pupils are implicitly aware that bodily control, symbolic space and the spatial self can be appropriated to serve group intention through a collated effort.

While school policy insisted that privileged space or adult space acts as a measure of bodily control, the pupils realise that approved behaviour can earn access to that space and be used towards their intentions. It is a complicity and commonality that wrestles bodily control from the original purpose of the space. Pupils commandeer the space through a concerted effort and sustain the appropriation of a privileged space. Symbolic spaces in the school of interest to the pupils were clearly read too. There was a clear understanding of function and form. The visual data attested to an awareness of the classroom for work, the staffroom for teachers, the yard for play, etc. This played into pupils' perceptions of space, how it was structured, and how certain spaces could be contested and changed to serve their own aspirations.

Lastly the spatial self, noted as how groups make sense of the places in which they find themselves, is implicitly understood by pupils as they strive to structure their spaces within the school. There is an inherent understanding of the fluidity and mutability in the production of complex spaces and rules and rituals. The pupils are part of this production and indicate it through the continuing effort to appropriate the spaces around them. In conclusion the data has suggested that the power to appropriate spatial and social relations, creating possibilities lies with pupils as much as with adults within the school environment. It is such conceptions of space that are a fundamental dimension to any teaching and learning environment.

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Children and their development as the starting point: A new way to think about the design of elementary schools

Alessandro Rigolon & Maxine Alloway

Although the active role of the environment in education has been widely accepted, only few schools render this consideration into built spaces. This is mostly due to a lack of communication between educators and designers. This paper aims to begin to bridge the gap between pedagogy and architecture by exploring aspects of child development and implications for designing developmentally appropriate environments. Five aspects of child development are considered: physical; ego; cognitive; social; and ethical. What is known about child development in each of these areas has significant implications for designing schools in new and innovative ways to better foster student learning. This analysis of child development highlights common themes of how schools should be designed including a variety of scale, exposure to nature, and interactivity of spaces. This interdisciplinary approach to design has significant implications for the development of school buildings.

IMAGINE walking into a building where everything is above eye level. With your head tilted back to take in your surroundings, you travel down what feels like a cavernous, never-ending tunnel. Every door you pass looks the same, the contents beyond each door blurring together in your mind with no individuality and no personal character. Now imagine someone said this was the place where you will be nourished, cultivated, and where you will find out who you really are. Every message the environment gives is that personalisation, creativity, and excitement have no place inside this large and static building. This is the experience of many elementary school children who attend schools designed with no regard for their development.

The environment of a school plays an active role in children's development, including the way they learn. This position is held by many developmental psychologists. Piaget and Vygotsky both claimed that learning and development happen through the interaction of children with the environment and people (Hunt, 1969). Psychologist and educator, Loris Malaguzzi (1998), the founder of the Reggio Emilia pre-school system, suggested that the environment is a 'third teacher', which has the power to speak to children and stimulate them.

The influence of the environment is widely recognised by architects and landscape architects, both in its physical components (space) and its relationship to socio-cultural meanings (place). In relation to schools, Nair and Fielding (2005) point out that the school building and grounds can be considered a three-dimensional textbook, offering curricular information, and helping children learn about social relations and norms (Sutton, 1996).

However, most school systems do not see space and place as actors in the learning process. Many school buildings across the world still reflect the traditional pattern of shoe-box classrooms along corridors. Architects can play a role and propose designs based on knowledge of child development, but the change must come from educators and communities (Hertzberger, 2008), the people who give meaning to schools. A deeper understanding and collaboration among school practitioners and designers is the key to going beyond traditional educational facilities.

This paper helps bridge the gap between educational psychology and architecture by

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giving evidence for the need for a more developmentally appropriate design. Five main aspects of child development (physical, ego, cognitive, social, and ethical) and their implications for design are discussed. Common themes among the aspects are then highlighted and related to concepts of space and place. The goal of this paper is to introduce a new approach that integrates aspects of child development into design insights for elementary schools.

Knowledge about child development

Childhood is a time of rapid development. This development occurs in all aspects of a child's life. For the purposes of analysis, we discuss five aspects of development separately, despite the overlapping and integrated nature of actual development. Knowledge about development in the physical, ego, cognitive, social, and ethical realms each have implications for the design of elementary schools.

Physical development

Physical development refers to changes in the body and one's control over one's body. This involves muscular control, co-ordination, and an increase in strength. During elementary school years, children learn to co-ordinate their bodies in relation to other people and space. They also further develop a sense of balance. Children do this through exploration, movement, and adventure. There is a natural desire for children to test themselves physically, much to the chagrin of caretakers who nervously standby as children climb, swing, and engage in other risk-taking behaviours. These behaviours serve an important purpose for a child's physical development. In addition, good mastery of movement and co-ordination is suggested to be fundamental for intellectual development (Olds, 2001). When children take physical risks, they are working on developing physically.

Children in elementary school are many different shapes and sizes. This is because physical development is different for different children. This is particularly true in the current educational environment, with a focus on including all children in general education classrooms, including those with physical disabilities. Elementary age children are learning how to control and manage their bodies as their bodies transform and grow.

Physical development has several implications for the design of the space and place where children spend more than 1000 hours each year. First, schools need to provide places for children to develop physical skills (Olds, 2001). Spatial elements should encourage different interpretative ways of getting around, from rolling and crawling to running and skipping. Large areas where children can jump, swing, climb, etc., are essential to overall child development, they are more than simply places for children to 'let off steam'. This includes playgrounds and gymnasiums, which are often subpar in today's schools (Malone & Tranter, 2003; Moore & Wong, 1997; McKendrick et al., 2000). Playgrounds are intended to encourage good health, allow free movement in a contained space, and provide opportunities to breathe fresh air (De Visscher & Bouverne-De Bie, 2008), all of which are important for development.

Schools should support development with ways for children to challenge themselves physically. The school environment should provide opportunities to develop physical prowess through such activities as walking on small objects, climbing trees, swinging high or cycling fast; additionally, schools should provide elements that challenge balance, such as tree trunks or low walls (Day, 2007). Research shows that although schools provide an area for physical activity, the design of most of these areas leave children bored and uninterested in engaging in anything other than a break from academics (Moore & Wong, 1997). Children are not, in fact, challenging themselves and enhancing their development, due to the few affordances provided to them.

In addition, spaces for physical activity must offer numerous and varied opportuni-

ties. Chawla (2006) writes about the importance of thinking about the relationship between the environment and the organisms interacting with that environment, often referred to as affordances. For children to meaningfully interact with their environment there must be affordances. However, affordances lie not in a particular object, but in the relationship between the object and person interacting with it. Based on the knowledge that children develop at different rates, what is an affordance for one child on a particular day may be meaningless to that same child on a different day or to another child. In order to provide all children within a school opportunity for further development, there must be many different objects, all of which will offer different affordances at different moments in time.

Finally, the knowledge that children are different sizes from each other (and from adults) implies that space should be designed from a lower point of view. Several scholars (Hertzberger, 2009; Lippmann, 2004; Nair & Fielding, 2005) suggest that children like smaller places, more fit to their dimensions. Schools designed with child development as their starting point would include nooks and crannies of different shapes and sizes appropriate for children of different shapes and sizes.

Spaces for children must allow for physical exploration, risk taking, and personal challenges in various ways, but must also be safe. Norris and Smith (2008) list safety as the most important consideration when designing spaces and products for children. Safety is a challenge for designers, considering that children's behaviour is unpredictable, due to a natural creativity that leads children to interpret the environment in multiple ways (Day, 2007). This involves paying attention to details and designing spaces that allow for errors. For example, furniture in schools must not only allow for children of different shapes and sizes but must also take into consideration safety issues related to children at various levels of motor co-ordination negotiating their way around the space. In addition, soft materials, such as rubber or wood chips in exterior settings, reduce the chance of injury due to falling. Trees and other play structures should not be too tall (five to eight feet) for the same reason (Day, 2007). While a certain degree of risk is always present (Hart, 2002), especially when dealing with activities related to physical exploration, the design of both indoor and outdoor objects can play an important role in reducing those risks, thus allowing for the variety of adventures necessary for physical development.

Children develop physically, at different rates, during elementary school. Thus, schools must be designed with varied spaces where children can challenge themselves in safe ways.

Ego development

During the years a child is in elementary school, that child is developing his/her sense of self. It is the time of life where children begin to understand and speak about the world outside of themselves, in relationship to themselves (Piaget, 1932). Montessori (1967) claims that children absorb all the characteristics of the environment, which influences who they will become.

In addition to developing a sense of self, children at this age are developing imagination. Common is the image of a young child immersed in an imaginary world that does not reflect reality. Fantasy becomes a bridge between the real world and the development inside the child. Nair and Fielding (2005) claim the importance of both imagination and creativity in today's and tomorrow's world. Nurturing the development of imagination and creativity is an important aspect of schooling for elementary children.

Related to this development of self is the need to feel safe in order to learn (Salzberger-Wittenberg et al., 1983; Watt, 1994). Research shows that children who feel anxious or unsafe are less motivated to learn (Entwistle, 1987). Three major aspects of design influence the perception of safety: the

feeling of crowding, the opportunity to know one's location, and physical anchoring. When children perceive crowding, they behave in a more aggressive and less interactive manner (Moore & Lackney, 1994), thus making it difficult for them to effectively learn in a classroom full of other students. It has been found that disorientation brings about a lack of security in people (Hall, 1976). Building on this, one can see how spatial clarity would bring a sense of reassurance to children. If they know where they are and can find their way, they feel more secure and at ease, and are more likely to focus on academic learning. Finally, a secure and solid physical anchor, enhancing the feeling of 'refuge', helps foster a feeling of security in children (Alexander et al., 1977; Day, 2007).

In order to support ego development and nurture a sense of self, schools must be designed with this knowledge. For example, the environment should avoid 'telling' too much or expressing a too clear symbolic meaning through mediums such as large murals with explicit subjects (Pairman & Terreni, 2001) or stereotypical images, for children can appreciate more complex signs representing nuances of real life objects (Tarr, 2001). With less overt messages children are able to build meanings and develop stories (Gable, 2000). For instance, artwork does not need to be simplified for children, for with guidance, children will make meaning of any piece of art. These opportunities turn the environment into a teacher, involving creativity and active thinking.

The design of schools should allow for creativity in other ways. Besides the obvious spaces for creative activities such as craftwork and art (Ceppi & Zini, 1998), there can also be other forms of sensory stimulation built into the school's design, such as different forms light and a variety of materials. The school environment can activate a series of sensory activities, particularly through the use of natural elements, helping children develop their personalities in relation to the environment.

The circulation space[1] can also be designed with child development in mind. Long hallways may be frightening to many young children because they are not able to see the endpoint of where they are going (Alexander et al., 1977). For this reason, some points of control along hallways, like narrowing or turning points, would be appropriate (Barret & Zhang, 2009). Also, Alexander et al. (1977) claim that circulation spaces should look more like a room than a corridor: independent zones with three or four classrooms help children identify the location, distinguish their room (Nair & Fielding, 2005), thus make them feel safer.

Other ways to enhance the sense of safety is to create space scaled to children's dimensions, like 'baskets' or niches (Dudek, 2000), or create a ' homelike' environment (Hertzberger, 2008). Those intimate settings, identified as 'home bases' with personalised meanings, can be present even in larger schools (Hertzberger, 2008).

The development of self, coupled with the importance of imagination and creativity means that children need schools that provide opportunities for them to determine the meaning of the environment and to learn through the creative use of materials, while feeling safe and secure.

Cognitive development

Cognitive development deals with an individual's construction of knowledge. While there are many theories about the construction of knowledge, it is generally accepted that children need opportunities to explore, reflect upon, and talk about new ideas. Children need to explore the world around them in order to learn. As John Dewey (1916) stated, 'The development within the young…takes place through the inter-

[1] Areas dedicated to the movement among classes, like hallways or atria, which can also be used for complementary learning activities.

mediary of the environment' (p.22). However, experiences alone are not enough to learn (Adams, 1991), for children need to reflect upon the stimuli coming from experiences and compare them to each other (Bruner, 1973, as cited in Adams, 1991). Cognitive development requires making connections between and among experiences (Adams, 1991). The repetition of experiences can help children conceptualise meanings through reflection (Adams, 1991). In addition to exploration and reflection, children need opportunities to talk about ideas with others. Learning is an inherently social phenomenon (Vygotsky, 1978; Wenger, 1998). The cognitive process includes a variety of steps, including experience, followed by reflection, conceptualisation, and social interaction; however, this is not a linear progression.

One theory in cognitive development is the concept of multiple intelligences (Gardner, 1983). Gardner suggests there are many different ways individuals can be 'smart' and each way is found to varying degrees within an individual. There is not one continuum of intelligence. This theory has had significant effects on education (Bransford et al., 2000). Using Gardner's (1983) premise, Nair and Fielding (2005), suggest that children learn in different ways, in different times, in different places, and from different people or places. Increasing the number of learning modalities addressed in a classroom has been found to significantly improve learning outcomes (Baumgartner et al., 2003; Ku & Sullivan, 2002). Gardner's theory furthers the idea that learning is complex and should be differentiated.

Hence, the designed environment should provide spaces for hands-on experiences, reflection, and social learning while providing teachers access to support each of the ways in which students may be intelligent. Schools should be designed to accommodate the variety of intelligences and individual needs of students (Barrett & Zhang, 2009; Nair & Fielding, 2005). Facilities built in the traditional way, with rectangular classrooms and corridors, do not do so. Changing the spatial features of classrooms and extending the learning settings beyond basic cells are two effective strategies to support all learners. For example, L-shaped classrooms allow various activities to take place at the same time (Lippmann, 2004). There must be space for both collaborative work and quiet individual study (Baglione, 2006). Spaces out of the classrooms, if designed with certain features (wideness, variety and natural lighting), can become 'learning streets' (Nair, 2005) where interactions with other people are positive events.

One of Gardner's (1983) intelligences most relevant to this discussion is spatial intelligence. Spatial intelligence deals with the ability to visualise space, understand how it is organised, and find one's way. Regardless of a child's natural intelligence in this regard, all children are developing their spatial competence during elementary school years.

Four spatial features can help children find their way in school buildings: landmarks, spatial sequences, functions and colours. Research shows that children use special points, considered landmarks, to organise their mental map and make decisions about their routes (Biel, 1982; Golledge et al., 1992), and that such devices are easier to memorise when they are placed at nodes (Golledge et al., 1992). Second, children tend to organise their usual routes in different parts, creating a sort of sequence to remember the location of settings along the path (Allen, 1981). Third, children tend to use the function of the destination as a way to orientate themselves (Christensen, 2003; Heft & Wohlwill, 1987). Finally, Olds (1987) suggests that colour is the most effective way to visually recognise space. For example, colour and other markers used to differentiate the various areas of the school, highlighting the functions or pointing out the presence of landmarks. The combination of these elements can be an effective way to facilitate way finding in school facilities.

Providing multi-sensory stimuli, opportunities for hands-on experiences, and spatial variations are important for creating schools where all students can develop cognitively, regardless of individual differences.

Social development

Social development involves learning to effectively interact with other people and positively contribute to a group. In elementary school, children leave their protected home environment and enter a world of peers with whom they must learn to socialise, sometimes for the first time. In addition to learning how to socialise with peers, elementary age children also learn how to get along with their community at large.

Social development is important not only to develop effective social skills, but is also essential to support the learning process. Learning is an inherently social process (Wenger, 1998), thus the ability to interact with others is both a skill and a means to an end.

Although space does not lead to automatic interaction (Gieryn, 2000), the design of schools can encourage socialisation. There are spatial devices that encourage some behaviours and discourage others (Moleski & Lang, 1986). First, the scale of spaces is important, because in small environments encounters are more likely to happen naturally (Pasalar, 2003). Second, social interactions are influenced by the boundaries and connections allowed, including transparency (Biner et al., 1991), as well as proximity (Gieryn, 2000). Third, children need places where they can stop by and start a conversation (Day, 2007), especially in public areas of the school. Therefore, flow patterns should be considered, and circulation spaces should be tangential to rest places, without interfering too much, but allowing social exchanges (Olds, 2001). Finally, the public flavour of places fosters interactions among people (Gieryn, 2000).

In schools, the private and public realms represent individual and collective identities. The patterns of socialisation among individuals are shaped by the environmental relationships between private and public space (Markus & Cameron, 2002). Hertzberger (2008) suggests enhancing 'spatial cohesion', avoiding fragmentation in the school layout, through the use of public places. For example, he recommends providing a main entrance and 'town square', avoiding separate access points and enhancing a 'sense of togetherness' (Hertzberger, 2008).

Related to learning how to socialise with the community at large, Hertzberger (2009) uses the metaphor of 'playgrounds as streets'. He states that schools are usually fenced-in, for safety reasons, but fear is having a disruptive effect on socialisation. The built environment has a strong impact on this phenomenon; in fact, walls and fences speak very clearly to people. There are many ways to encourage connection with the community, through the use of school gardens (Desmond et al., 2004), shared facilities with community-based organisations (Cooper & Vincent 2008; Sullivan, 2002), and community involvement in the design process and customisation of the school (Sutton, 1992). Community connectedness can enhance the sense of belonging, which has positive consequences on the school climate and learning (Uline et al., 2009).

The physical environment can play a role in preventing social problems in schools (Day, 2007; Malone & Tranter, 2003). The space should provide enough room to not feel crowded (Malone & Tranter, 2003), but should remain scaled enough to allow children to feel some control over it. Avoiding large monotonous areas and providing settings for different play activities is a way to reduce dullness and prevent negative behaviours (Lambert, 1999, as cited in Malone & Tranter, 2003). Buildings and school grounds should have a gentle feel, through the use of green elements and texture as well as grid patterns of appropriate size. Thus, schools should have a warm, welcoming feel to their design.

As children learn how to interact with others during elementary school, the school

can support this development through a variety of spatial devices, attention to the relationship between public and private spaces, and supporting connections between the school and the community. Doing so may have an added benefit in reducing common social problems among young children.

Ethical development

Ethical development, as defined in this paper, deals with one's behaviour and disposition towards other people and the environment. Developing responsibility and sense of citizenship, a generally accepted goal of schooling, requires the development of care and concern for other living things. This includes a development of right versus wrong, respect for the natural environment, and respect for human diversity.

According to Piaget (1932), young children tend to accept the laws imposed by their guiding adults but as children interact with those outside of their immediate family, in places such as school, they start developing independent definitions of what should and should not be done. In addition, Kohlbert (1971) suggests that the rules shared by a group of people shape behavioural patterns. Children tend to regulate their actions on the basis of expected behaviours within their group of people (Jensen-Campbell & Graziano, 2005). Therefore, positive interpersonal contacts can enhance children's ethical development.

Although it is difficult to teach a sense of right and wrong through designed environments, places can convey values. For example, space can communicate responsibility and care when it is well kept and maintained (Uline et al., 2009), encouraging children to learn to care themselves and get involved. In addition, when areas are accessible to everyone, including those with disabilities, values of inclusion are promoted, in contrast to having separate places for separate people. The built environment can play a role in children's ethical development of right versus wrong.

In addition to developing a sense of right and wrong, elementary school children also learn how to care for the environment. Most scholars claim that children are born with an innate form of empathy towards nature, involving affinity, attraction and a sense of wonder (Carson, 1956; Cobb, 1977; Kellert, 1993; Orr, 2000; Sobel, 1996). This strong emotional connectedness to nature is a value that has to be cultivated; otherwise it risks being overshadowed by the commodity-oriented culture of our society (Kellert, 1993; Orr, 2000). Chawla (1998) suggests that direct experience of nature during childhood is the most significant factor in building a sensibility toward the environment.

Research shows that the way spaces (especially the outdoors) are designed can make a difference for the development of ecological literacy (Moore & Cosco, 2007; Moore & Wong, 1997; Murphy, 2003; Wechsler et al., 2003; Zask et al., 2001). The school grounds and buildings can provide meaningful experiences of natural elements and phenomena such as the water cycle and food cycle. For example, there can be systems for water collection such as cisterns (Keep, 2002; Wilks & Hes, 2008). In addition, the creation of small ecosystems such as woods and ponds can provide valuable experiences because children can have everyday contacts with the plants and animals (Titman, 1994). Moreover, a sustainable building can work as a learning tool, showing its functioning as a complex machine (Wilks & Hes, 2008). Greenhouses can help demonstrate the issue of heat transmission (Moore & Cooper Marcus, 2008; Wilks & Hes, 2008) while windmills (Keep, 2002) and solar or photovoltaic panels (Heitor, 2009) can show how to use the wind and the sun to produce energy. Finally, environments that afford manipulability, such as gardens, encourage children to take control of their physical setting, enhancing their sense of responsibility (Desmond et al., 2004). Combined, these devices can become effective three-dimensional textbooks if they are easy to use and appropriate to children's development (Blyth, 2009).

In addition to developing respect for the environment, it is important that elementary school children develop respect for human diversity. Social identity, which is mostly built through interpersonal relationships (Kohlberg, 1971) and the experience of place (Sutton, 1992), plays an important role in developing respect for diversity. As children grow and develop, they come into contact with peers and adults belonging to the category of 'other' , including ethnicity, social class, physical and cognitive abilities. When dealing with diversity, fear and disinterest can derive from a lack of knowledge: for example, children living in gated communities are more likely to perceive racial and class diversity as threatening (Low, 2001).

Learning to accept other people and cultures may start from sharing space with them. Schools that, through their layout and atmosphere, facilitate interactions can teach students to respect diversity. Hertzberger (2008) suggests that the public space of the school is the place where children go and meet others. For example, Reggio Emilia schools are designed with a piazza – a place for unexpected meetings and the creation of a social identity (Ceppi & Zini, 1998). Classrooms are arranged around the piazza, on the same level; hence there is no hierarchy between them, all the groups have the same importance, and all of them converge into the central public space (Ceppi & Zini, 1998).

School facilities should be a 'built' way to express ties to the local community (Nair & Fielding, 2005), and should find a way to include all the different group identities, making them feel 'at home'. This requires designers to study the communities in which they are building schools, and ideally, to engage communities in the process of design. Doing so can create schools that foster an appreciation for the diversity of human life.

As children's behaviours and dispositions towards other people and the environment are developing, the physical environment can foster the caring, respect, and interactions desired by a community.

Discussion

The discussion of five aspects of child development that are pertinent to elementary school-age children highlights three themes: variety of scale, exposure to nature and the interactivity of spaces. Each deserves special attention when designing learning environments for children.

Variety of scale

Scale refers to the size, real or perceived, with which spaces are designed. Schools must be designed from a child's vantage point, allowing children to perceive the space as somewhere they belong. This also helps create a sense a safety that leads to positive ego development and social interactions.

Schools must involve a variety of scales, including large areas for physical development, small areas for reflection, and public areas for socialisation. A balance must be found between small and large, for reduced dimensions can give the impression of overcrowding (Martin, 2006), while too large ones diminish the sense of control (Alexander et al., 1977). Likewise, large buildings make orientation and wayfinding difficult for children (Golledge et al., 1992), but buildings that are too small do not allow for the variety necessary.

Hertzberger (2008) suggests that the city can be a metaphor for a good large/small balance in schools. With the phrase 'the school as a city', he points out that in the overall layout the building should provide a hierarchy of spaces. He suggests a finger-plan layout, which encompasses areas of different sizes.

Variety in scale can also provide access to children of all different shapes, sizes, and abilities, leading to both ownership and an implicit message about the value of all individuals. A diverse human environment, such as a school, requires spaces of different scales, for individuals, sub-groups, and the whole community.

The way people interact is influenced by scale, and issues such as bullying can be

reduced via carefully designed spaces. The traditional model of schools as large, box-like buildings does not afford the variety of scale necessary to support development. Scale must be considered if one desires a school designed with child development in mind.

Exposure to nature

Connection to the natural world is important for child development. Exposure to nature teaches ecological literacy and helps nurture children's innate affinity towards the natural world (Chawla, 1998).

In addition to enhancing environmental awareness, the natural world offers a large range of affordances and gradual physical challenges (Chawla, 2006) which are important considering children develop at different rates. For example, a tree in a playground invites children of different sizes and physical abilities to find ways to climb and challenge themselves. The tree is not reserved for 'big kids' or 'sporty kids' the way a piece of playground equipment might be perceived. Something about the naturalness of the tree encourages inclusion. This is true of the natural world in general.

This natural inclusion creates environments that promote ethical social interactions, if coupled with appropriate human actions. Nature is an informal setting, encouraging children to socialise (Moore, 1986). It has also been shown to reduce social conflict (Malone & Tranter, 2003). Immersing children in the natural world can assist those hoping to teach children how to treat others with respect and dignity. Nature offers things to talk about and interact around, while promoting values of diversity.

Another advantage of exposing children to the natural world is the imagination that typically accompanies this exposure. Natural settings are the strongest source of inspiration for children's stories and play (Moore & Wong, 1997). A tree can be a spaceship, a house, a many armed monster, or anything else a child imagines. Nature encourages creativity in a manner that is good for child development.

Finally, naturalistic intelligence (Gardner, 1983) is one way an individual can be smart. With nature throughout a school environment, those children inclined toward such intelligence may excel in ways traditionally reserved only for those linguistically intelligent. At the same time, all children will cultivate this intelligence for future use.

The natural world offers diversity, opportunities for interaction, starting points for imagination, and provides support for those teaching children how to effectively and ethically interact with others. Therefore, designers should maximise the presence of nature within the school building – through in-between spaces like greenhouses – and in the grounds, including small ecosystems like ponds and woods when possible.

Interactivity of space

The final theme that surfaced in the investigation of developmental factors and their implications for the design of schools is the need for an interactive environment. This refers to children and the community needing to be part of the on-going design of a school's space. Spaces that can be manipulated are valued positively by children (Titman, 1994; Malone & Tranter, 2003) and provide a series of benefits for their development.

When space is interactive, children have opportunities for hands-on experiences that support personal and interpersonal development. The environment plays a role in the definition of a child's sense of self (Proshansky et al., 1983) through the opportunity to create a place perceived as fitting to one's identity (Korpela, 1989). For example, design could provide only a few framing elements that constitute the 'hardware' of the setting in places such as hallways and allow children to create the rest of the design.

In addition, an interactive environment allows creativity and imagination to flow, as children determine what they want their space to look like. When schools are designed to be interactive, socialisation with

all children is supported, as children have something to talk to others about. Gardens are just one example of something both interactive and natural which provide these opportunities.

As children learn, grow, and develop they need to feel a sense of control in order to explore, interact, and feel safe. Interactive designs create ways for children to have some control over their built environment. For example, if children can manipulate their physical setting, they can adapt the setting to be appropriately challenging for personal development.

The community should also be involved in the design of a school, as community involvement supports social and ethical development. Schools designed with input from the community communicate the values and diversity found amongst those living there, rather than those of the designers.

Sustainable buildings can be an example of an interactive environment because they can be designed to engage people in the running of the building. In such a case, users adopt behaviours such as opening or closing certain windows during a given time of the day. This not only involves children in a hands-on manner, but also teaches about care for the environment in a way that has real consequence, such as being too warm or cold if proper care is not taken.

When schools are designed in ways that allow children opportunities to explore and control over their environment, overall development is supported.

Conclusion

This paper provides insights into the design of learning environments for elementary schools based on an analysis of five aspects of child development. This multidisciplinary approach is an attempt to ground architectural design in scholarship about child development, making the design more objective and less dependent on personal interpretation of the designers than has traditionally been done. People are brought to the centre of the discussion, as space is shaped according to the way children develop. This discussion can be used as a starting point for a more effective dialogue between education and architecture, in which shared decisions can bring about real change. Such schools can offer rich environments that foster personalisation, creativity, and excitement as children learn and develop.

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Flexibility and placemaking for autonomy in learning

Rosie Parnell & Lisa Procter

Flexibility is a key aspiration of contemporary government guidance on school design. Used liberally, the term provides a convenient site for the meeting of educational approach (think flexible, personalised learning, timetabling, groupings) and spatial design (non-bounded, open space, moveable elements, independent structure and services). However, this meeting seems to pose a challenge. As Building Bulletin 95 puts it: '…the most flexibly designed spaces can only work if building users have a flexible attitude.' Framing flexibility in the discourse of autonomy, this paper contends that it can be understood as a 'tool' to enable children to experience authorship of their own learning. The paper draws on participatory action research with primary and secondary schools in England in which the built environment and placemaking were explored as a means to support learning. Through examples, it is argued that once children are enabled to experience their learning environment as 'flexible', by changing it themselves, they are better able to self-direct their learning. Findings show that flexible learning space is encouraged when children and teachers experience together how their environment can support their learning needs. Once established, it is an environment that is constantly changing according to the needs of individuals and groups. The paper concludes that flexibility, at the congruence of spatial design and learning, can only be attained once children feel trusted to shape their environment within an enabling school culture.

Keywords: *Flexibility; autonomy; school design; placemaking; pedagogy; personalised learning.*

Constructions of flexibility within school design discourse

FLEXIBILITY is a key aspiration of contemporary guidance on school design in England (DfES, 2002; DfES, 2004; CABE, 2007). At the heart of the argument for flexibility is the commitment to individual learner need and what has been proposed as 'personalised' learning (CABE, 2007, p.18). (This problematic concept will be returned to later.) A flexible learning space is, therefore, generally portrayed as one which can be reconfigured by its users to support a variety of learning needs. Different spatio-physical responses to this design challenge can be seen in design guidance as well as school architecture. *Building Bulletin 95* (BB95), a key guide to school design in the recent context of England, outlines one of the most common approaches, which essentially relies on the presence of large standardised spaces, which can be divided-up with moveable partitions. This becomes the means to create spaces of a range of sizes and by inference, support 'varying activities' and 'individual need' in a school (DfES, 2002, p.18). This interpretation of flexibility, 'attempted through uniformity', or 'minimal differentiation of the space', has been criticised with reference to its potential similarity with the some of the problematic open-plan schools of the late 1960s and early 1970s (Woolner et al., 2005, p.37).

Other, perhaps less bland, approaches see interpretation and ambiguity as the basis for flexibility. Herman Hertzberger, a renowned designer of Montessori schools among others, is most associated with 'interpretable' forms, echoing notions of Gibson's theory of affordances[1] as explained here:

[1] Gibson's theory of affordances proposes that individuals discover the possibilities of their actions in the environment by perceiving the affordances of either objects within the environment or the environment itself (Gibson, 1979/1986).

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> *a thing exclusively made for one purpose, suppresses the individual because it tells him exactly how it is to be used… Therefore a form must be interpretable – in the sense that it must be conditioned to play a changing role.* (Hertzberger, 1969, cited in Dudek, 2000, p.5)

While the moveable partition is intended for one specific purpose, with limited room for interpretation, the 'interpretable form' is by definition intended to be used and perceived in multiple and as yet unknown ways. Though quite different in physical quality, the work of school designer Bruce Jilk is conceptually comparable in its inclusion of 'intentional ambiguities', intended to allow children 'the freedom to create their own environments' (Jilk, 2009, p.320).

Common to all of these approaches to spatio-physical flexibility is the underlying aspiration to avoid the architectural determinism so criticised in those schools of the late 1960s and early 1970s, which saw teachers handed environments designed for a particular educational ethos and lacking the flexibility to accommodate other approaches (Woolner et al., 2005, p.37). All of these variants instead assume that responsibility lies with the occupant – to varying degrees – to change, appropriate and shape the environment in response to diverse individual needs. While some examples tend towards the 'blank canvas', others seek to invite and even prompt the creative interaction of the users: flexibility begins to embrace the occupant as well as the physicality of space.

While this accommodation of 'contingency concepts' (Jilk, 2009, p.314), including unknown occupant perspectives, might be seen as a 'democratic' approach to design, there remain two major problems with the assumption that the occupants will change, appropriate and shape their environment. First, as Woolner et al. note in their comprehensive review of previous phases of school building, history and environmental psychology suggest that people simply tend not to change their physical environments (2005, p. 38). It is a common tale that even contemporary (and expensive) moveable concertina partitions are rarely, if ever moved in some schools[2]. In England, where built environment education is a low priority and teacher training includes no substantial consideration of the relationship between space and teaching, it is unlikely that teachers or students will prioritise the physical environment when exploring ways to improve learner experiences. An even more powerful barrier in this respect perhaps is the socio-cultural environment. A flexible physical environment and knowhow are not enough. *Building Bulletin 95* summarises this issue neatly: '…the most flexibly designed spaces can only work if building users have a flexible attitude' (DfES, 2002, p.19). In order to support a truly flexible learning environment, it is argued that learners (and their teachers) need to feel enabled to appropriate and shape their environment to support their learning needs.

The second problem is related to the contemporary aspiration for 'personalised' learning, which in large part underpins arguments for flexibility in England. This needs to be understood in the context of the wider rationale that personalisation provides for contemporary public-service delivery, where 'users' are enabled, in theory, to 'co-produce with professionals a solution to their needs.' (Hartley, 2007, p 629).

Flexibility as personalisation? Reappropriating flexibility for autonomy in learning

The UK policy aspiration for personalised learning, as set out in a Labour party conference speech in 2003, at first appears child-centred and benign:

[2] One of the authors having witnessed, for example, one such partition that was in use as a display wall and would not have been easily disentangled from its layer of paper, card and sticky tack to accommodate any spontaneous response to learner need. Many similar anecdotes abound.

> *'…personalised learning': an education system where assessment, curriculum, teaching style, and out of hours provision are all designed to discover and nurture the unique talents of every single pupil…*
> *…the most effective teaching depends on really knowing the needs, strengths and weaknesses of individual pupils. So the biggest driver for change and gain is use of data on pupil achievement to design learning experiences that really stretch individual pupils…* (quoted in Johnson, 2004, p.2)

Alternatively, personalised learning can be viewed as a symptom of a neo-liberal agenda. Framed by the Prime Minister as: 'services fair for all, personal to each'. Public services that harness the drive of competition, and the power of choice to the public sector ethic of altruism and equity' (29 January 2004 speech, quoted in Johnson, 2004, p.3). This 'revised code of education' (Hartley, 2007) has been criticised for its basis, which is said to lie 'less in educational theory, more in contemporary marketing theory' and consumerism (Hartley, 2007, pp.629–630). As Hartley (2007, p.630) argues:

> *Personalisation is associated strongly with the notion of 'choice': that is to say, of choosing that which is thought to accomplish personhood. There is an affinity, therefore, between consumerism and personalisation.*

Given these arguments, we propose that the 'personalisation' of space is an unhelpful way to think about a flexible learning environment, since it suggests that each individual has the freedom and choice to also 'consume' their environment in exactly the way they wish. This can never be the case in a shared environment and neither is it an appropriate ideal in a world that is also shared and interdependent. Instead we turn to the more helpful concept of autonomy, which is rooted not in marketing and neo-liberal discourse, but in education theory. Learner autonomy is here proposed as a more appropriate rationale for flexible learning environments, where autonomy is understood as:

> *The competence to develop as a self-determined, socially responsible and critically aware participant in (and beyond) educational environments, within a vision of education as (inter) personal empowerment and social transformation.* (Jiménez Raya, Lamb & Vieira, 2007, p.1)

This definition critically acknowledges the interdependence of those involved in school and beyond, while simultaneously valuing self-determination and personal empowerment. These concepts are expanded in Figure 1, which outlines the assumptions behind the definition. In order to achieve flexibility, it has been argued that socio-cultural dimensions of the learning environment need to be addressed as well as the spatio-physical. Learners (and their teachers) need to feel enabled to change, appropriate and shape their environment to support their learning needs. The next part of this paper will explore a project which sought to enable such actions – to enable what we call here placemaking. Rooted in the principles of autonomy, this project encountered both the socio-cultural and the spatio-physical dimensions of the (potentially) flexible learning environment.

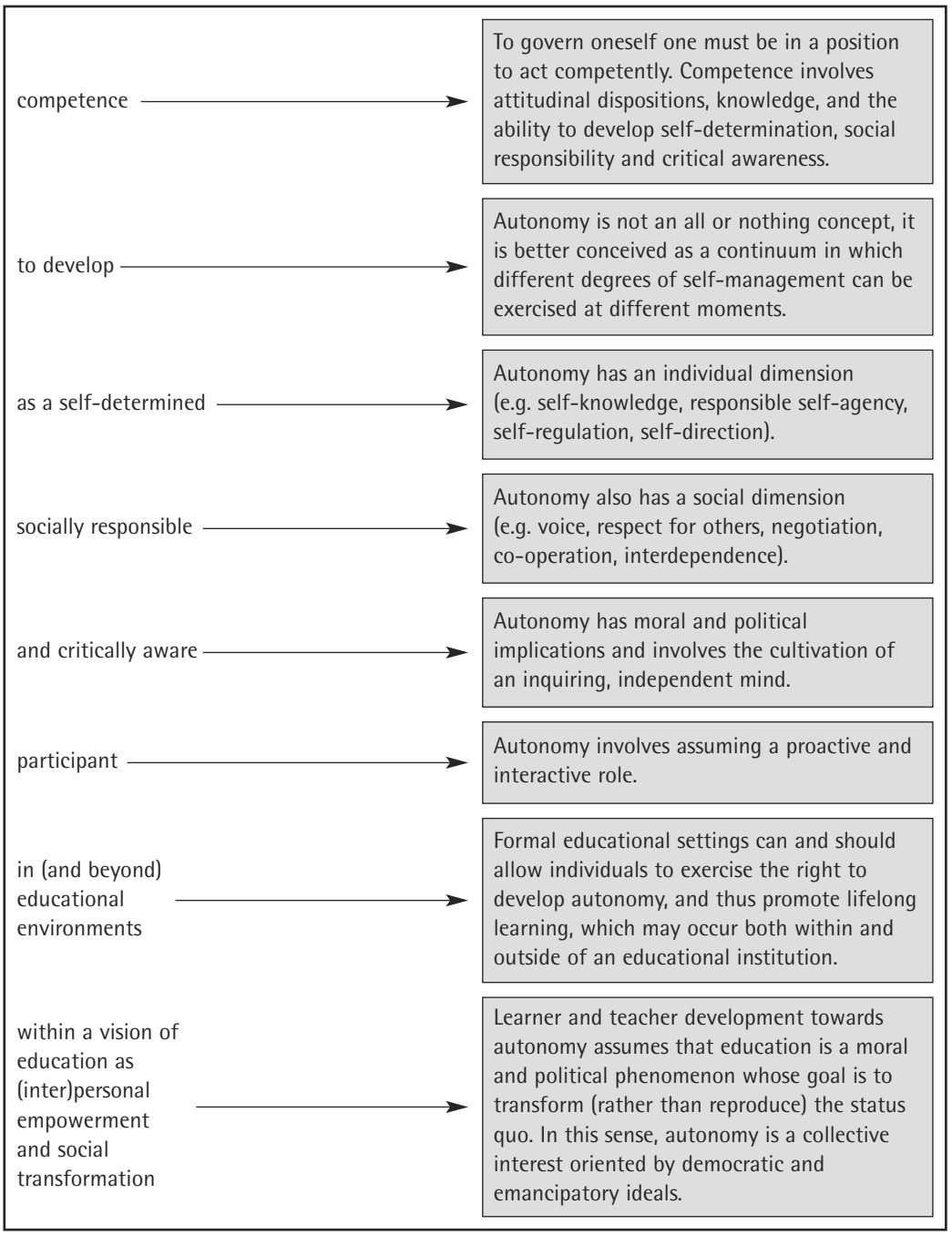
A pedagogy of placemaking for flexibility and autonomy in learning

Context for the study

The study in question draws on four school-based projects that were part of a larger programme of built-environment-related learning, funded by the Paul Hamlyn Foundation (2006–2008). The programme framed the built environment both as a vehicle for and also a subject of learning activities, the primary goals being to:

- develop young people's confidence and ability to make their voices heard with regard to the design of architecture and the built environment;
- challenge under-achievement by providing young people with an alternative, hands-on approach to learning; and

Figure 1 (Jiménez Raya, Lamb & Vieira, 2007, p.2).



- engage young people in creative arts activities, exploring architectural design and their own experiences of the built environment.

Around 700 young people from in and around Sheffield took part. Five primary, two secondary schools, and two children and youth groups participated as core partners in action research: some in short projects and others via extensive programmes integrated into the school timetable over a number of months. These participants ranged from 5- to 25-years-old. We worked closely with our co-researchers – teachers and students – to develop and facilitate a range of built-environment-based education projects over a period of 18 months. Each project was unique, responding both to the opportunities the setting presented and the individual and collective voices of those who took part. Common to all projects was the pedagogical approach aspired to by the authors (as project initiators), which was rooted in principles for autonomy. Jiménez Raya, Lamb and Vieira (2007, p.58) describe the following nine pedagogical principles for autonomy:

- *Encouraging responsibility, choice and flexible control;*
- *Provision of opportunities for learning to learn and self-regulation;*
- *Creating opportunities for cognitive autonomy support;*
- *Creating opportunities for integration and explicitness;*
- *Developing intrinsic motivation;*
- *Accepting and providing for learner differentiation;*
- *Encouraging action-orientatedness;*
- *Fostering conversational interaction;*
- *Promoting reflective enquiry'.*

Flexibility (or flexible control) is here highlighted as being key to the development of autonomy and was an important aspiration of the programme. Pedagogy for autonomy has itself been framed as 'a flexible approach where teachers play a decisive role in creating learning opportunities...' (Jiménez Raya, 2009, p.4)

Research participants and aims

The study focuses on the four specific projects for which placemaking was a key feature, each of which culminated in a tangible, designed spatial output. Placemaking is here taken to include changing, appropriating and shaping the physical environment.

The participants in these four projects were as follows: Primary school A – 24 pupils aged 7 to 11, 1 teacher; Primary school B – 27 pupils aged 6 to 7, one teacher, one teaching assistant; Secondary School A – 25 pupils aged 11 and 12, one teacher; and Secondary School B – 20 pupils aged 13 and 14, one teacher. While these projects had the same broad aims of the project as a whole, the co-researchers also contributed a specific focus for reflection, through their emerging interest in developing flexible learning environments for and through placemaking. The aims of the present study are, therefore, to:

- identify a set of principles that underpin placemaking as a method for the development of learner autonomy; and
- identify the opportunities and challenges that exist when trying to introduce flexible learning environments within schools.

Methodology and methods

Participatory action research provided the methodological framework for the study, each project involving the teachers and the students in discussing the broad aims of the programme at the outset as well as defining and revisiting the direction and goals of the sub-projects. As co-researchers, all of the staff and pupils both gathered and generated data, adopting the role of participant observers. The following analysis draws on qualitative records of these observations and participants' reflections, as recorded in the facilitator's own field notes (made after each session), transcriptions of facilitated group reflection sessions with all participating pupils (held regularly at the end of the individual sessions) and separate semi-structured group interviews with participating teachers and with pupils reflecting on the projects'

processes and impacts, following their completion.

The data analysis process began by identifying moments that represented placemaking activity– using the facilitator's typed fieldnotes as the data source. These moments included both impromptu placemaking initiated by the children as well as placemaking activities planned by the workshop facilitators. Once identified, all of the qualitative data relating to these moments was gathered – including relevant passages from the group interviews and facilitated reflective sessions, to provide a rich picture, including a range of perspectives and voices. These texts were coded and examined for any emerging themes, with particular attention to the roles and relationships of the different participating actors before, during and after the placemaking activity. The following sections describe five key principles, identified through this analysis, which underpin an emerging pedagogy of placemaking for flexibility and autonomy in learning. Also explored are the inherent difficulties and areas of resistance to these processes that were encountered.

Findings

Placemaking as an active process

The practice of placemaking was based on the principle of children choosing to take part in learning opportunities provided for them. Within this choice we acknowledged the responsibility for schools, teachers and other practitioners to evoke curiosity amongst children to foster their engagement. However, as Embleton-Tudor et al. recognise, 'if [students] are genuinely free to learn, then they are more likely to be curious' (2004, p.165). This choice, or intrinsic motivation, to participate continued during placemaking activity, whereby teachers and students made active decisions about what they wanted to contribute and how they went about doing so at different times within the learning opportunity.

The principle of choice within mainstream education, both in terms of taking part and making decisions about how to take part, meets a whole range of obstacles. The research was free from many of the usual constraints upon choice in education, such as curriculum objectives and assessment. This freedom allowed teachers and students to explore, without fear of targets or scrutiny, the potential to make choices about the physical environment. As a result, the project revealed conflicts around active choice in schools related to space and placemaking.

Linda, 8-years-old, was an enthusiastic participant in one of the projects. In an interview with Linda she explained that she viewed herself as 'invisible' amongst her peers. Teachers also described her as a girl who found it difficult to make and maintain friendships as school. During the project, Linda frequently placed herself in visible locations within the environment:

> *Linda (and her friend) ask to make notes as the discussion is going on. I say that is a great idea. They stand high on chairs, like stone lions guarding a stately home, at either side of the whiteboard.' (Fieldnotes)*

Linda was also actively invisible at times. The following extract is taken from a workshop in which the students were creating imaginary worlds for a wizard inside cardboard boxes.

> *I asked to look at her work. It was fantastic, she had made curtains, and behind the curtains she was creating a world full of monsters. It was beautifully constructed. She was very engaged. There was another box next to her. I asked if she was making two… (this was Linda's box). Linda came over and held up some pink curtains she was making out of paper for the cover of her box… About 10 minutes later, Linda asks me if she can lock herself inside the stockroom. She and Vicky have pulled a table inside the stock room and the door is ajar. I explain to her my discomfort with the ideas, 'what if you get locked in?' She takes me inside and shows me the lock. She has proved it is safe. I explain that she can work there as long as she opens it if I knock the door. She agrees…' (Fieldnotes)*

Linda was engaged in her own learning within both these situations. Her increased self-directed appropriation of the environment appeared to be directly related to her levels of engagement in the activity. Yet, these spatial choices pose a tension within schools. What if Linda injured herself away from an adults view? Who would be responsible? As Lupton (1999) reminds us:

> *…in contemporary Western cultures, every death, every accident and every misfortune is chargeable to someone's account- someone must be found to be blamed* (p.45).

The potential threat a child out of view poses for a teacher in terms of accountability limits the choices children can make in relation to placemaking. Tensions such as this create barriers to what is referred to in 'Pedagogy for Autonomy' as, people being 'agents of experiences rather than simply undergoers of experiences. This perspective… involves learners in performing a wide variety of purposeful actions or tasks whereby they are developing academic or learning competencies.' (Jiménez Raya et al., 2007, p.640).

Placemaking as an exploratory process

This aspect of placemaking recognises teachers' and students' critical engagement with their reality through their exploration of the immediate environment. They were encouraged to question the culture and practice of the environments they were learning within, with the aspiration and support to bring about change. The participating teachers acknowledged that this questioning required time and willingness, from all involved, to reflect upon their experience and endeavour to understand other people's points of view.

The participating schools applied to take part in the projects proving they were enthusiastic and receptive to the challenge of changing the physical environment from the outset. As each project progressed, teachers and students commented upon how the medium of space enabled them to question and reflect more widely on pedagogy to inform the designs and interventions they developed. Fostering an inquisitive attitude toward the cultures and practices they were part of exposed tensions, particularly between internal beliefs and external procedures and protocols. Some students from a Year 1 class (aged 5 to 6) experienced this tension through the process of creating interventions for a space in their school – 'the link'. As they transformed the space from a corridor, purely for circulation, into a space for play, they struggled to reconcile the disparity between what the space should be and what they wanted it to be.

The link is a glazed corridor that connects two of the nursery infant school buildings. Children described the link as 'boring', 'dull' and 'cold'. It reminded them of a 'stinky rat'. They perceived it as a circulation space; 'It's boring (because) it's boring walking'. They wanted the space to be like a colourful 'parrot' or warm like a 'polar bear' covered with thick fur.

The children reinterpreted the link by creating storyboards full of vibrancy and warmth, showing what might happen in the changed space. The majority assumed that the link would serve the same function. They imagined people would walk through and only look at the 'decorations' en route elsewhere.

The children decorated the link five times to correspond to each of their designs. Once each transformation was complete the class were permitted to freely explore the space. The children touched the space; made up games in the space; told stories in the space; they jumped in the space. In their words, 'we went mad in the link'. They were giving the space purpose through actively exploring the changes. The space was redefined as exciting, imaginative, vibrant, fun! They changed it into a space with a new purpose – play. The children began to anticipate that future uses of the space would be playful; 'why don't we put some balls in there…for football?'

The transition to a play space posed a challenge for some of the children. One child stated, 'I thought it was the play-

ground' and another, 'I'd like it if in the playground there was a link and every week we could change it'. These kinds of comments expose learned protocols about when and where play can happen at school, reminding us of the limited spaces within which children are supported to play (Else, 2009, p.64).

The rule that playing is for the playground is completely turned on its head in this project, through the students being supported, by their class teacher, to follow their instinctive responses to an environment that evokes play. The teacher also shared the same dilemma – they expressed their enjoyment of watching and being part of the children's playfulness and, at the same time, were conscious and anxious about children's safety and, most prominently, noise levels. Placemaking, in this instance, encouraged the participants to challenge traditional conceptions of indoor and outdoor space, relating back to a pedagogy for autonomy, which:

> *'refers to a vision of education as empowerment and transformation rather than oppression and reproduction. This means that learners and teachers are seen as critical (rather than passive)'* (Jiménez Raya et al., 2007, p.6).

Importantly, the participants also created an opportunity for others to be part of this questioning as they entered and engaged with the transformed space.

Placemaking as a shared process

The case-study projects have shown that students' engagement in the placemaking process, and in particular their willingness to make choices about how they used their learning environment, related to whether its principle values relating to flexibility were shared by the participants. An important aspect of flexibility in the socio-cultural environment lies in the balance between control and freedom. Jiménez Raya et al. (2007, p.5) address this balance within autonomy:

> *Student-control – which is an essential component of autonomous learning – is not a single, unitary concept, but rather a continuum along which various learning situations may be placed. There are degrees of student involvement that the individual teacher can facilitate, taking into consideration not only the amount of responsibility students are prepared and able to assume, but also the contextual circumstances of teaching and learning. This implies that student and teacher roles have to be constantly negotiated and redefined as pedagogy for autonomy evolves.*

At the start of the project, teachers expressed their openness and enthusiasm for the theoretical and ideological rhetoric of flexibility in teaching and learning and, at the same time, were daunted by the reality of co-negotiating such an approach with students. In one of the secondary schools, a high-achieving group of Year 9 students (aged 13 to 14) embarked upon a project to develop design proposals for their local park. From the outset, the project offered opportunities for the students to make choices about what they would do and how. The students, when reflecting back upon the project, expressed how unfamiliar this way of working was for them. For some, they chose to disengage with the activities through opting to sit out of class discussions or initiate conversations or games with others unrelated to the project. The teacher described this as a response to the locus of control moving from him to the students:

> *As the project has gone on they have become a lot more independent, more willing to share ideas and try those ideas out. Whereas, normally what happens is that they tend to be quite closed about their ideas… Normally we, [the teachers], are the ones that are in charge and leading them, sort of, step by step through the project whereas this time I was sort of taking a back seat and they were leading themselves… As teachers, we are used to having to be in control and having to do things in a set way… [with]… set objectives about what has to happen in every classroom and every lesson… There are students in school that really, sort of, engage with a structure. For them if there's a structure there,*

> *they'll thrive on that and do really well, which is probably why [they] are in the top set. If you take that structure away, they are left with very little and they don't know how to fit into the group or to the lesson.* (Year 9 teacher)

The teacher describes a perceived link between students' reliance upon a structure pre-defined by a teacher and high achievement. However, for many, the initial disengagement was replaced by what the students collectively described as 'being independent'. One of the students, Catherine, commented upon this for herself.

> Researcher: *Has it changed what you think learning is?*
>
> Catherine: *Yeah, it has actually. Learning's where teachers are not just telling you what you got to do and teaching you stuff; it's making yourself think and think of your own ideas and being independent…*

The students recognised that their increased confidence to make their own decisions, developed in one dimension through being able to appropriate their environment to support the activities and tasks they were engaged in, led to increased independence. We can relate this to Gatto's theory of 'provisional self-esteem or conditions of worth' (Gatto, 2005/1992), where the constant assessment and judgement of individual students is seen as restricting capacity for 'independent' learning.

Placemaking as a collaborative process

In each of the case-study projects, the placemaking processes that encouraged the participants to form and re-form their learning environment, were aimed at promoting a shared responsibility for ensuring everyone felt at ease to explore and create alongside others. Through doing so, we recognised that some of the participants were able to assess the impact of the environment upon others in order to create a setting that recognises and respects people's diverse needs.

This shared responsibility was addressed by supporting the young participants to define their own roles within collaborative placemaking activities. This approach, which valued the different needs of individuals as well as the shared goals of the group, challenged conceptions of hierarchical power that underpin the culture of mainstream schooling. Fielding describes this in terms of the relationships between teachers and learners:

> *Contemporary teacher professionalism needs to incorporate an expectation that teacher learning is both enabled and enhanced by dialogic encounters with their students in which the interdependent nature of teaching and learning and the shared responsibility for its success is made explicit.* (Fielding, 2001, p.130)

One of the case studies, in particular, also reveals the importance of addressing this issue on a student-to-student level too. A group of 24 'gifted and talented' students participated in one of the projects in a primary school. The students were of mixed-ages from Year 3 to Year 6 (ages 7 to 11). The project was framed around the title, 'A Hideaway for Wizard'. As the project developed, the students chose to build the Wizard's Hideaway in their school grounds. The students took increased responsibility for their lessons, deciding what they needed to consider and create in order to achieve their aim of building the hideaway. This also included making decisions about which spaces in the school to use and how to set up these spaces to engage as effectively as possible in the different tasks chosen by small sub-groups. Initially, having a shared input to something owned by all, worked well. However, over time some of the students found it increasingly challenging to reconcile their own and other people's ambitions for the hideaway, resulting in arguments between individuals wanting to develop the project in different ways. Tensions will always exist in collaborative practice. However, in this situation the students appeared to renegotiate hierarchies because they lacked familiar classroom positions and disciplinary techniques for maintaining these. The students instead situated themselves through hierarchies relating to age:

Researcher: *How has it been, working in a group?*

Rachel (Year 3): *If it's with people I know it's best. If it's with people I don't know, err… If it's with Year 6s like Steve and err, what's her name, whatever, they always think that, um, they all think that because they're year 6s and because they're bigger than us they can take charge of us like when I was in Steve's group, he used to shout at me a lot just because he was bigger than me and he was in Year 6…*

George (Year 3): *But when I'm in my class I'm like the King. Most of them are my friends… When I come to Architecture, I'm like kissing the Year 6's feet.*

Rachel (Year 3): *Yeah, it's like they take control of us.*

These comments reflect two things; the importance of perceiving respect from peers and the tendency to situate oneself within a hierarchical delineate. This tendency highlights one of the obstacles to what Fielding (2001) describes as, 'the most difficult conceptual and practical issues confronting many societies across the world today…the development of an inclusive, emancipatory community' (p.130).

Within autonomy a more equal community is developed through 'achieving greater interactional symmetry among unequal participants' (Jiménez Raya et al., 2007, p.64). However, this example highlights the difficulty in achieving this when the students' tendency is to reproduce systems that discriminate and order the world according to constructs of being better or worse.

Placemaking as a responsive process

The project participants, including teachers and students, shared their experience of transforming their implicit awareness into explicit knowledge concerning how different learning processes and needs – which can change from moment to moment for any individual – may be supported through placemaking activity. Teachers, in particular, expressed their increased understanding of how students choose to inhabit their environment in response to what it is they are doing through applying the principle of 'flexible control', acknowledging 'the capacity of the learner to exercise different levels of control' (Jiménez Raya et al., 2007, p.59). This permitted teachers to observe the students' different spatial choices and, as this Year 9 teacher comments, to 'understand' the students:

> *It's really hard to understand how they work and what they get from the work until you understand them. And we don't, as teachers, get time to understand them, before we try and teach them the work. Because everybody learns in different ways… It's sort of determined on how they've learnt in the past, what experience they have had and there's so many factors that go into it…knowing them a bit more really helps understanding how they can learn and how they can get a bit more from their lessons.* (Year 9 teacher)

Where conditions permitted, students instinctively appropriated their setting in response to the tasks they were engaged with and their own related preferences. A Year 7 teacher reflected upon how students found it easier to respond flexibly when they were in the large open space of the hall:

> *They like having that amount of space, they are usually in one classroom and quite stuck to the classroom, you know, in rows, in desks… The ones that need to get up and have a little walk around have got more space to do that… and I'm aware that some of my [students] need, they need part of marching up and down to get their brains working, or having a bit more space to maybe lie on the floor. They've got that freedom…they're all over, some are on the floor, some are up near the windows, some are sat at desks, but they are finding the way that suits them best. They are discovering how they learn best.* (Teacher)

Through teacher and learner co-reflections upon these experiences, all parties can gain an awareness of the different learning needs that the environment can support. In turn, these different needs can be better provided for within the learning environment.

Concluding thoughts

Flexibility in school design has the potential to be a powerful force for good in learning. However, a vague and ill-defined rhetoric for personalised learning has steered flexibility towards becoming a vacuous notion; inherently good and unquestionable due to its apparent child-centredness. What makes a flexible learning environment in physical terms is still a subject for exploration, with little work having been done to build a relevant evidence-base. Is the ability to create large and small spaces enough? Does the blank canvas provide the neutral backdrop for user intervention, or does placemaking require 'generators' in the form of pro-active spatial and physical prompts? Different school designers have offered different responses.

This paper argues that a physical environment – no matter what its design – is not flexible until the occupants 'enact' that flexibility. People cannot be subtracted from 'flexiblity'. In this sense, flexibility is about individuals and groups being able, through the provision of both physical and social freedoms, to take an active role in forming and reforming, on a moment-by-moment basis, the form (how it looks and is arranged) and function (how it is used) of their environment. It is, therefore, proposed that flexibility can be developed and enhanced through enabling processes, which address both the spatio-physical and socio-cultural dimensions of the flexible learning environment. Our approach to this has been to pursue a placemaking process with students and teachers.

At the heart of the described approach lies autonomy, proposed as a robust and appropriate rationale for flexibility. If we are to support students to engage in a developmental process towards autonomy, a flexible learning environment is essential. At the same time, we need autonomous learners and teachers in order to make viable changes to the environment. The relationship between flexibility and autonomy emerges as symbiotic.

The active, exploratory, shared, collaborative and responsive placemaking process that we describe in this paper has enabled children to experience their learning environment as 'flexible'. We argue that when children feel trusted to change, appropriate and shape their environment themselves, they are better able to self-direct their learning. In particular, a flexible learning space is encouraged when children and teachers experience together how their environment can support their learning needs.

However, this case study has also revealed a range of potential difficulties and areas of resistance in attempting to make the rhetoric of flexibility a reality. In order to support students to become placemakers, the teachers and facilitators in this case study had to be flexible in the level of control they asserted in the process. These demands for flexibility sometimes met resistance from the teachers themselves, sometimes from the particular organisation's (school's) culture, the school's structures, or from 'school' and 'schooling' in the widest sense. Among the barriers that need to be overcome to enable such a form of flexibility are class sizes and structures, timetabling, the aspiration for still, quiet bodies during learning, a conditioning in some students to want to be 'led' and the teacher's own sense of self and authority.

Finally, it must be noted that the internal environment of the school – a world essentially ordered and controlled by staff – is essentially a manifestation of adults' power (see Foucault, 1980, p.98) in the adult-child relationship in school. The act of a child changing the physical environment, is therefore a significant visible manifestation of a challenge to the traditional power structures of a school. Such structures are so deeply ingrained in our understanding of school and 'schooling', and our wider culture as a society, that resistance to flexibility is inevitable. The challenge presented by flexibility – so liberally pursued – should not be underestimated. However, once established, the flexible environment – at the congru-

ence of spatial design and learning – is one that is constantly changing according to the needs of individuals and groups.

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Classroom soundscape

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The acoustical qualities within a classroom are referred to as its soundscape. Classrooms are environments full of sounds and student learning depends largely on how well the relevant messages are discerned within its soundscape. In the ideal classroom, the message is heard and understood with little or no effort. When teachers must raise their voices in order to be heard the listener may not get a clear signal across the full range of speech sounds. Being able to focus on relevant sounds is a fundamental factor accounting for learning the phonology of speech which underlies learning to read and write. Reverberation, noise, and distance between the speaker and listeners all contribute to the classroom soundscape. Student characteristics also contribute including hearing impairment, developmental disabilities, and specific deficits in learning, attention, speech, language, or auditory processing. In addition, second language learners cannot rely on previous linguistic experience and must depend more heavily on hearing the spoken messages accurately. The use of sound-field amplification has received a great deal of attention in the literature. Benefits of this technology include improved attention and learning in students as well as improved vocal health in teachers. The classroom environment has been described as more calm and relaxed when the soundscape is favourable. This paper reviews the literature and draws conclusions about these acoustical features which are essential for an optimal learning environment.

THE SOUNDSCAPE of a classroom refers to the auditory aspects of the learning environment (Anderson, 2004). In order to be successful learners, students need to focus on important sounds, such as speech, whilst not attending to background noise. The classroom soundscape affects the effort students must use in order to receive and understand all of the audible messages that are relevant to their learning. Students must be able to discriminate the individual sounds in words to clearly understand what they hear (Flexer, 2005). The sounds that make each word distinct and provide intelligibility for the listener are the high frequency sounds, such as /th/, /f/, and /s/. The lower frequency sounds, such as the vowels, carry the power or audibility of the message. In a noisy environment, the high frequency sounds are masked which may result in spoken messages being audible, but not intelligible (Flexer, 2005). That is, students may hear speech but not fully understand what is being said.

This paper focuses on the auditory elements involved in understanding verbal messages within the classroom environment. It should be mentioned at the outset that visual aspects of the environment also play an important role in students' comprehension of spoken language. In background noise, being able to see a speaker talking improves the listener's ability to recognise that a message is occurring (Rosenblum, 2008).

Non-verbal aspects of linguistic messages are transmitted through hand and body movements as well as facial expressions (Gagné, 2001). All sighted students benefit from being able to see a speaker's face clearly. Aspects of a speaker's verbal message such as pitch changes, word stress, and intonation can be perceived by watching movements of the lips, jaws, and cheeks (Rosenblum, 2008). It is especially critical for students with hearing impairments to watch lip movements to facilitate speech reading (Gagné, 2001). The visual environment can be enhanced by using good lighting, not turning one's back on listeners, and avoiding shadows on the face when standing in front of strong light sources,

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such as a sunny window (Kaderavek & Pakulski, 2002)). Thus, teachers should remember that both proper acoustic and proper visual environments are important when planning for optimal classroom learning.

Creating a favourable listening environment for teaching and learning takes into account the characteristics of the students, the acoustical qualities of the room, and the technology being employed to distribute sounds in the room. Characteristics of students that can influence the accuracy with which they hear auditory messages in the classroom include their developmental level, hearing status, learning ability, and language experience. The clarity of the teacher's voice is also an important aspect of the soundscape since the speech of the teacher is often the most relevant audible signal that students need to understand. No matter what auditory message is most relevant, it must be heard against a backdrop of various sources of noise in the room. Classroom acoustics involve complex relationships amongst multiple factors within the space, including reverberation, background noise, and the distance between the speaker and the listeners (Berg, Blair & Benson, 1996; Crandell, Smaldino & Flexer, 2005). In many classrooms, teachers are not clearly heard by the students due to the noise level or other aspects of the classroom environment. Sound-field amplification can help to enhance teachers' voices and allow them to speak in conversational tones so that all students are able to hear the message clearly.

This paper reviews the literature on the characteristics of students that affect listening, room acoustics as they apply to classrooms, and sound-field amplification technology. Each of these elements has a role in the classroom soundscape.

Student characteristics

An adult's perception of teachers' spoken messages in the classroom differs from a student's perception. Since adults have fully developed auditory systems and advanced vocabularies, they are better able to listen and attend in noisy environments. Hence, it may be difficult for an adult to discern that the classroom environment is not optimal for children's listening. It is recognised that children's hearing systems are immature prior to adolescence and young children are less attentive and more distractible (Anderson, 2001; Boothroyd, 2004; Jamieson et al., 2004; Nelson & Soli, 2000). Further, young students are still having the life experiences and developing the language skills to accurately fill in the gaps when some of the sounds of spoken communication are not accurately heard (Palmer, 1997; Seep et al., 2000; Smaldino & Crandell, 2005). Hearing clearly the sounds of the teacher's speech is essential since acquiring the phonology of oral language is a fundamental factor in literacy learning (Flexer, 2004, 2005).

It has long been known that students with hearing deficits are negatively affected by poor classroom acoustics (Berg et al., 1996; Crandell, 1993; Flexer et al., 1994; Flexer, Wray & Ireland, 1989) and the prevalence of hearing loss among school-age students is as high as 11.3 per cent (Bess, Dodd-Murphy & Parker, 1998). When students who hear well learn using auditory channels, they process sound-based information efficiently and accurately and frequent auditory stimulation helps develop the auditory pathways of the brain (Flexer, 2004, 2005). Any degree of hearing loss not only negatively impacts a student's ability to hear language accurately in the classroom, and thus to efficiently learn the literacy concepts which are critical to academic success, but also affects neurological development.

Crandell et al. (2005) stated that students with fluctuating conductive hearing loss, often from recurrent middle ear infections, may have associated speech, language, intellectual, and attentional problems. Flexer (2005) points out the strong link between hearing and the early learning of foundational literacy concepts. Children who experience intermittent conductive hearing loss

in their early school years may miss critical auditory input that forms the basis of literacy which underlies all learning. Even slight hearing loss has been related to deficits in vocabulary, reading, and other academics (Nelson, 1999).

Many classrooms today include students with a wide range of special needs. In addition to permanent hearing loss, individual differences that may negatively impact the ability to listen in the classroom include developmental disabilities as well as specific deficits in learning, attention, speech, language, or auditory processing (Bennetts & Flynn, 2002; Cornwell & Evans, 2001; DiSarno, Schowalter & Grassa, 2002; Flexer & Long, 2003; Smaldino & Crandell, 2005). Some students whose hearing is compromised at times by recurrent middle ear problems may be identified with many of these learning difficulties (Anderson, 2001, 2004; Flexer, Millin & Brown, 1990; Ray, Sarff & Glassford, 1984). Thus, students with special needs who struggle academically can be further impeded by not always being able to accurately perceive the spoken messages in the classroom.

For students who are learning in a classroom which is not conducted in their primary language, their limited linguistic experience adds to their need for a clearly understood acoustic signal (Crandell, 1996; Crandell & Smaldino, 1996; Nelson & Soli, 2000). These students cannot rely on prior linguistic experience and, therefore, must depend more heavily on accurately hearing the verbal messages of their teachers and peers (Nelson et al., 2005).

In summary, there is a vital link between the well-organised neurological development of children's auditory pathways and the efficient learning of language that is necessary for academic success. Students need to be able to hear and understand the verbal messages in the classroom accurately to strengthen these processes. This is especially relevant for students whose hearing systems are still developing, who have a hearing impairment or other disability, or who are learning a second language. In conclusion, students with attention, speech-language, and/or learning difficulties should be screened to rule out hearing deficits as a potential factor contributing to their educational concerns. It is important to identify hearing problems as early as possible so that treatment can reduce their impact on learning.

Classroom acoustics

Whilst students' characteristics influence their ability to listen, the impact of room acoustics on classroom listening must also be recognised. Three factors which contribute to room acoustics are reverberation of sounds off surfaces, the level of background noise, and the distance between the speakers and the listeners (Nelson & Soli, 2000; Smaldino & Crandell, 2000).

Reverberation

Reverberation refers to the sound waves that reflect off hard surfaces in the room, rather than travelling directly from the speaker to the listeners' ears (Smaldino, Crandell & Kreisman, 2005). Reverberation time (RT) is the amount of time required for a signal to decrease 60 decibels (dB) below its initial level (Crandell, Smaldino & Kreisman, 2004). Speech perception is more negatively impacted the longer the RT (Anderson, 2004). If the RT in a room is 1.0 second or less, an adult with normal hearing would have adequate perception of spoken language (Smaldino et al., 2005). In regard to school settings where students are learning through speech, the Acoustical Society of America (2002) has set a standard RT of 0.6 seconds maximum for unoccupied classrooms of typical size (ANSI S12.60-2002).

Many classrooms do not meet the ANSI S12.60-2002 standard and have RTs of 1.0 second or more (Knecht et al., 2002; Seep et al., 2000). When reverberation levels are too high, the intelligibility of the speaker is negatively affected. This results in the students hearing a less clear signal from the source of the spoken language such as the teacher, the

other students, or a sound-based media presentation. There are several methods to reduce reverberation in classrooms, such as installation of acoustic ceiling tiles, which can be recommended by audiological or acoustical consultants (engineers or others with specialised knowledge of acoustics in schools). These professionals can evaluate existing spaces and be involved in the design of new classrooms or school buildings (Smaldino, Doggett & Thunder, 2004).

Background noise

Background noise is another acoustical characteristic of the classroom environment that can interfere with students' ability to listen and clearly understand what they hear. The Acoustical Society of America's (2002) standard for an acceptable classroom noise level is 30 to 35dB using an A-weighted scale (a measurement that resembles human hearing). The speech signal should be at a volume high enough to be heard intelligibly over the background noise, a concept referred to as the signal-to-noise ratio or S/N. The Acoustical Society of America (2002) has set a standard for classroom S/N at +15dB above the background noise. In their review, Shield and Dockrell (2003) discuss similar standards for the UK.

Many studies have found that typical classrooms have noise levels exceeding these standards (Crandell & Smaldino, 2000; Flexer, 2005; Knecht et al., 2002; Nelson et al., 2005; Picard & Bradley, 2001; Sato & Bradley; 2008). Noise can derive from sources external to the school building, external to the room, or inside the room (Crandell & Smaldino, 2005). Some of the noise can be reduced once the sources are recognised.

When a new school location is being considered, planners should avoid loud external noise sources, such as airports, railroads, and highways (Choi & McPherson, 2005). In their review of classroom noise, Shield and Dockrell (2003) note that noise from road traffic is recognised as a major problem by teachers in urban schools in the UK. Increasing the awareness of the effects of external noise such as lawnmowers and traffic can help school personnel to minimise their effects by keeping windows closed when needed.

When planning classrooms within a new building, sound-absorbing materials and ceiling heights need to be considered with the acoustical environment in mind (Siebein, 2004). Positioning classrooms away from noisy areas such as a gymnasium, cafeteria, or music room are essential design considerations (Seep et al., 2000). When noise sources are in the hallways, such floor-cleaning machinery, classroom doors should be closed to minimise the effects.

Noise can also come from sources inside the classroom such as mechanical equipment and voices. Room designs which help absorb noise, as well as improve reverberation levels, include the use of acoustical ceiling tiles and sound-absorbent panels on upper walls (Siebein, 2004). Cork bulletin boards and bookshelves that break up flat wall surfaces also help to absorb background sounds as well as does arranging the seating so that students are away from noisy electronic equipment (Crandell & Smaldino, 2005).

Heating, ventilation and air conditioning (HVAC) systems are often cited as major sources of background noise in classrooms (Choi & McPherson, 2005; Nelson & Soli, 2000; Siebein, 2004; Seep et al., 2000; Sutherland & Lubman, 2004). Selection of noise-controlled HVAC systems in the initial design of the building is the most cost effective way to reduce classroom background noise from this source (Seep et al., 2000). Standards for controlling the noise of these systems are provided by the American acoustical design guidelines for schools (Acoustical Society of America, 2002). Steps can also be taken to improve the noise level of existing HVAC systems, for example, by using quieter fans or insulating the ductwork (Seep et al., 2000).

Additional background noise sources in classrooms may include electronic equipment vibrating, chairs and desks scraping

across floors, and fluorescent lights humming (Nelson & Soli, 2000; Smaldino & Crandell, 2000; Smaldino et al., 2004). Such noises can be addressed by placing soft pads under vibrating equipment, adding rubber tips to desk and chair legs, and regularly maintaining the ballast in fluorescent lights (Crandell & Smaldino, 2005).

There is a complex relationship amongst the background noise, the task, and the students (Anderson, 2004). Some of these interactions are the following: noise involving spoken language tends to be the most distracting; the learning of tasks that are more cognitively difficult or less familiar is more negatively affected by noise; children younger than 13 to 15 years of age are more affected by background noise; and long-term high classroom noise levels are related to reading deficits (Anderson, 2004). Furthermore, when listeners need to make an effort to hear a spoken signal above the background noise, they must carefully attend and concentrate on picking up the relevant phonological aspects of the message, leaving less cognitive processing capacity for comprehension of the meaning of the message (Picard & Bradley, 2001).

Distance

Distance is another major factor involved when considering classroom acoustics. As the speech signal travels across a room, its sound level drops. Siebein et al. (2000) found that furniture arrangement and selected teaching strategies can be utilised to reduce the impact of distance on students' listening. They recommended small group instruction at tables, story-time groups gathered in one area in a room, especially a carpeted area, and teachers' movements through aisles as opposed to standing only at the front of the room. Teachers' awareness of the benefits of these techniques in minimising the distance between speaker and listeners can improve students' understanding of spoken messages.

In summary, reverberation, noise, and distance are the common factors addressed in the literature on classroom acoustics. The acoustical design of classrooms is a significant problem in many schools. Classrooms are often reverberant and noisy environments. Teachers' voices or other auditory signals, such as students' speech or sound-based media, need to be heard above a high level of background noise. It is also important to be aware of the effects of the distance between the speaker and listeners in the classroom on comprehending speech. When problems related to the acoustical design of a classroom are identified, solutions that improve the soundscape may be available.

Audiologists or acoustical consultants familiar with standards for room acoustics in educational settings should be consulted for advice when planning modifications to address poor room acoustics (Smaldino et al., 2004). These professional can evaluate the situation and use their expertise to find workable solutions. It should be noted that reverberation, noise, and many other factors that affect room acoustics are more effectively addressed and less costly when they are included in the initial stages of planning a new school (Sutherland & Lubman, 2004; Siebein et al., 2000; Siebein, 2004). Therefore, these professionals should also be involved when new schools are in the planning stages (Smaldino et al., 2004).

Sound-field amplification technology

The first step toward enhancing the classroom listening environment is to address the acoustical problems as effectively as possible. If the signal-to-noise ratio continues to be problematic then it may be worth considering the use of sound-field amplification technology (Crandell & Smaldino, 2005; Nelson & Soli, 2000). Sound-field distribution, rather than sound-field amplification, has been recommended as more descriptive since the new term focuses on the teacher's voice instead of on all the sounds in the room (Flexer, 2002, 2004). Sound-field systems enhance the teacher's voice with a microphone and speaker system. Their purpose is to allow the teacher's voice to be

clearly heard by all students above the background noise. Amplification allows teachers to speak in conversational tones, which relaxes the classroom atmosphere and reduces the teachers' voice strain.

The use of pass-around hand-held microphones can also be part of a classroom amplification system. Hand-held microphones can help students to hear their peers clearly. In tasks where students' oral responses are intended to be part of the learning environment, the use of the pass-around microphone can highlight the relevant spoken message. For example, the microphone may be passed to a student who is answering a question, reporting on a group activity, or giving an oral report to the class. The microphone also helps students who are shy to be heard more clearly by their teacher and peers (Iglehart, 2004). Flagg-Williams, Rubin and Aquino-Russell (2009) found that when hand-held microphones were used, quiet students were no longer requested to speak louder and shy students were more likely to participate when they knew they would be heard. Flexer (2005) reported that amplifying students' voices increases incidental learning opportunities in the classroom. On the other hand, Iglehart (2004) in his study of school-age students with cochlear implants found that spontaneous conversation can be impeded while waiting for the microphone.

Typically, in a noisy classroom teachers increase their volume in order to be heard. One problem this creates is that a raised voice does not provide clear signals across the full range of sounds (Pakulski & Kaderavek, 2002). As noted earlier, intelligibility refers to the ability to discriminate each individual sound within spoken words, especially the high frequency sounds where most of the meaning is carried. Thus, whilst teachers using loud voices may be heard above the background noise, and the vowel sounds may be louder, the sounds that are significant to understanding word meanings are not all necessarily clear to the listeners (Flexer, 2005).

Extensive research has found that the use of sound-field amplification benefits students with and without special needs (Sockalingam et al., 2007, for review). Studies have reported academic gains (Arnold & Canning, 1999; DiSarno et al., 2002; Flexer et al., 2002; Millet & Purcell, 2010; Ray et al., 1984) in amplified classrooms. Sound-field amplification has also been shown to increase the speed of student responses to teachers' directions, students' body orientation toward instructional interaction, and participation in class discussions (Cornwell & Evans, 2001; Eriks-Brophy & Ayukawa, 2000; Maag & Anderson, 2006; 2007; Ryan, 2009). On the other hand, Nelson et al. (2005) found improvements in young second-language learners' speech perception, but not in their on-task behaviours.

Also, it should be noted that studies have found that in a typical noisy, reverberant classroom, some young children with mild to moderate hearing loss perceive teachers' messages more clearly with desktop or personal listening devices as compared to classroom sound-field distribution (Anderson & Goldstein, 2004; Iglehart, 2004). Thus, the decision to use amplification in a particular classroom should be evaluated carefully. Whilst the need for amplification technology is not disputed for students with hearing impairments, Anderson and Goldstein (2004) stress the need for further research to explore how various types of technology best meet individual students' listening needs.

Teachers who use a classroom amplification system typically respond positively toward its role in the teaching and learning environment. Students' attention is noticeably easier to get and maintain (Flexer & Long, 2003). Some studies reported on improved learning environments since students are more able to relax their efforts to hear above the background noise. For example, classrooms tend to become quieter and calmer for students whilst teachers feel less stressed and less fatigued (Anderson, 2001; Eriks-Brophy & Ayukawa, 2000;

Flagg-Williams et al., 2009; Flexer, 2004; Flexer et al., 1990). There is a reduced need for repetition of instructions and transitions are easier (Palmer, 1998). With sound-field amplification systems, teachers can move freely around the classroom without the concern of how well students can hear their messages (DiSarno et al., 2002). Students sitting in all parts of the room can hear the verbal message at a constant volume even though the distance between the teacher and each student may change.

Teachers also benefit from the use of sound-field amplification because it reduces their voice strain. The prevalence of vocal problems for teachers has been well documented in the literature (de Jong, Kooijman et al., 2006; Russell, Oates & Greenwood, 1998). Further, the limiting of teaching activities due to voice strain (Smith et al., 1998) and the decrease in the intelligibility of teachers who have voice pathology has also been reported (Picard & Bradley, 2001). It has been recognised that pre-service teachers also experience voice health issues during their practice teaching (Simberg et al., 2000; Thomas et al., 2007). Some of the problems that can occur with high frequency amongst teachers are voice tiring or weakness, hoarseness, vocal nodules, and laryngitis (Preciado-López et al., 2008; Roy et al., 2004; Simberg et al. 2005; Yui, 2002). The use of a sound-field system may reduce or eliminate the need to use a loud voice in the classroom, reduce vocal strain, and decrease vocal fatigue (Jónsdottir, Laukkanen & Siikki, 2003; Sapienza, Crandell & Curtis, 1999).

In summary, sound-field amplification technology is an effective method for enhancing the vocal signal above the high level of background noise found in typical classrooms. Its use should be evaluated for an individual classroom along with an assessment of the room's acoustical qualities. Through the use of this technology, students can benefit from increased attentiveness and better listening and teachers can benefit from improved vocal health.

Final comments: Enhancing the classroom soundscape

The classroom environment contains a complex soundscape. In today's inclusive schools, there are many students who need an enhanced listening environment in order to accurately hear the sounds and structures of their language which are critical for literacy learning. Neurological pathways associated with auditory processing need to be stimulated efficiently and consistently for healthy growth and development (Flexer, 2005). Further, many students need the teacher's voice to be clear to help them maintain attention and learn effective school behaviour. The acoustics of the classroom environment affect its soundscape as does the use of amplification technology (Smaldino & Crandell, 2000). When the breadth of the various components is recognised, it is clear that the concept of a classroom soundscape is multifaceted.

Evaluation of the soundscape of a school or classroom requires an awareness of the complexity of the components involved as well as expertise in assessing acoustics and implementing amplification technology. Educational audiologists and acoustical consultants should be involved in identifying classroom acoustics issues and working toward solutions for both existing structures and new construction (Smaldino et al., 2004).

In the US, voluntary acoustical standards (Acoustical Society of America, 2002) have been drafted with guidelines on reverberation times and noise levels for schools and classrooms, as well as recommendations for applying them in a variety of educational settings. In the UK, comprehensive regulations for the acoustical design of schools went into effect in 2003 with substantial detail on best practice for implementation (Shield & Dockrell, 2003). In Canada, where the present authors are located, there are currently no national standards for classroom acoustics. Implementation of recognised standards would increase the likelihood of school building designers

incorporating acoustical features that result in favourable listening conditions. Increased awareness of the complexity of the various components within a classroom soundscape is vital for moving toward the provision of clear auditory signals in all classrooms for all students.

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Kindergarten kids in motion: Rethinking inclusive classrooms for optimal learning

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Recent cognitive neuroscientific evidence indicates that movement and gesture are necessary for optimal cognitive and communicative development. Unrestricted movement may enhance learning because it allows children to freely engage with external properties of their environments. In-depth understanding of how children interact with/in classrooms and other everyday environments is lacking. This knowledge gap is particularly problematic for children with physical disabilities because gross and/or fine motor impairments restrict their movement, and exclusionary attitudes, safety concerns and environmental barriers further curtail their ability to explore their surroundings. Hence, all children's physical health, social abilities and cognitive development may be jeopardised when built environments and educational strategies inhibit rather than enhance their movement capabilities. In this paper, key studies from neuroscience, pediatric rehabilitation, ecological psychology, architecture and education are examined to identify how children with varying physical abilities respond to and interact with the physical features of everyday environments, and how contextual factors influence their mobility and ability to learn. Drawing on these research findings, a novel conceptual and methodological framework is proposed for observing and analysing children's 'body-environment' interactions in an integrated kindergarten classroom. The proposed framework accentuates the indisputable link between movement and optimal learning outcomes, and addresses the need for descriptive, naturalistic research about children and their environments. Ultimately, this interdisciplinary approach may optimise: (1) the design of learning environments that support children's fundamental right to access and move freely within them; (2) the development of their physical, social, cognitive capacities; and (3) environmental, educational and rehabilitation interventions that encourage children to explore, navigate and shape their environments.

IT IS NOW widely recognised that disability results from complex interactions between persons with bodily impairments and environmental, attitudinal, and social factors (UN Convention on The Rights of Persons with Disabilities, 2006; Ottawa Charter, WHO: 2007; International Classification of Functioning, Disability and Health, WHO: 2001). As a result, research and treatment goals have moved beyond identifying the etiology and ameliorating the effects of bodily impairments, to redressing physical, social and attitudinal barriers facing disabled persons of all ages.

Moving about and playing freely in indoor and outdoor environments is an important pre-requisite for children's physical, psychological and social wellbeing (Day, 2007; Spencer & Blades, 2006; Huttenmoser, 1995; Pellegrini, 1988; Dwyer et al., 2008; Piek, 2008; Taub & Greer, 2000; Kyttä, 2004; Prellwitz & Tamm, 2000; Holt, 2004). Recent cognitive neuroscientific evidence indicates that movement and gesture are also necessary for optimal *cognitive* and *communicative* development (Broaders et al., 2007; Diamond, 2000; Rowe & Goldin-Meadow, 2009). This research has demonstrated that unrestricted movement enhances learning because, through movement, children engage with external properties of their environments. The use of hand gestures seems to make it easier for children to link their developing mental representations to aspects of the environment, and to facilitate new insights during problem solving (Cook, Mitchell & Goldin-Meadow, 2008). Investigators suggest that there is a synergy between

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cognitive knowledge and bodily knowledge, and that children learn through movement rather than by relying solely on their verbalisation or recollection skills (Cook et al., 2008; Broaders et al., 2007; Rissotto & Tonucci, 2002). These findings corroborate other recent advances in neuroscience that highlight the importance of motor activity for the establishment and reinforcement of neural pathways (Damiano, 2006), and emphasise the need for a new model of cognition that conceives the mind as rooted in bodily action and environmental interaction (Garbarini & Adenzato, 2004).

An important contribution of the first decade of environment-behaviour research (the 1970s) was the re-incorporation of the physical environment into certain areas of psychological theory and research, and later into child development (Moore, 1986). One limitation of this research however was the restricted conceptualisation of the environment and the minor emphasis placed on the *physical* environment and its role in the ecology of human movement and development (1986). While some research has demonstrated the effects of contextual factors on children's mobility, health and development (Moore, 1986; Wohlwill & Heft, 1987; Kyttä, 2004; Fjørtoft, 2004; Spencer & Blades, 2006; Pollock & Stewart, 1998; Tieman et al., 2004; Rigby & Gaik, 2007), further understanding of the 'ecological' interaction (Howard, 2008) between children and their physical environments is needed. Moreover, children traditionally have been expected to curtail and restrict their movement by sitting still and moving in regulated and practiced ways in environments such as school and health care settings (Foucault, 1975). Hence, knowledge about the experiential primacy of 'real world' settings (Heft, 1988) and the resources they offer to support children's movement is urgently needed.

Although this knowledge gap is problematic for all children, it is particularly so for those with physical disabilities. Virtually nothing is known about how disabled children respond to environmental features or about the mobility strategies they use to interact with these features. Gross and/or fine motor impairments restrict their movement and exclusionary attitudes, safety concerns and environmental barriers further curtail their ability to explore their surroundings (Tieman et al., 2004; Spencer & Blades, 2006; Wooley, 2005; Prellwitz & Tamm, 1999; Holt, 2004). As a result, these children do not have the same 'mobility license' (Kyttä, 2004) to play and actively investigate their worlds as their non disabled peers (Day, 2007; Rigby & Gaik, 2007). Finally, disabled children have fewer opportunities to develop their intrinsic physical capacities when they are inhibited by therapies and admonitions that encourage 'normal', socially acceptable bodily movements and gestures (Sapey, Stewart & Donaldson, 2005; Oliver, 1993; Hansen & Philo, 2007).

The vast majority (91.2 per cent) of the 22,000 Canadian school-aged children who have mobility impairments attend regular schools (Statistics Canada, 2001; Canada Council on Social Development, 2006). Some research in school settings has demonstrated that access to a variety of experiential activities enhances physical, social and cognitive development (Spencer & Blades, 2006; Moore, 1985); these activities however differ in the extent to which they offer opportunities for playful exploration, independent mobility and new bodily actions, and the discovery of new, functionally significant environmental features (Heft, 1988; Kyttä, 2004). Furthermore, the physical, spatial and social aspects of school environments communicate symbolic messages about what is expected to happen within them, and consequently restrain children's behaviour (Martin, 2006; Kielhofner, 1995; Holt, 2004). Similarly, the movement strategies and 'playfulness' of children with cerebral palsy have been shown to be much less constrained in their homes than in schools (Tieman et al., 2004; Rigby & Gaik, 2007). These findings reflect the fact that disabled children are

encouraged to move in 'socially appropriate' ways outside the home (Oliver, 1993; Hansen & Philo, 2007; Tieman et al., 2004), and that most schools are designed and built for 'normally' developing children (Armstrong, 2003; Chiles, 2005; Edwards, 2005; Fielding, 2000).

Since the 1980s, there has been an increasing demand to educate disabled children within integrated classrooms (UNESCO, 1994; UN Convention on the Rights of Persons with Disabilities, 2006). It is clear, however, that placement in mainstream settings does not alone achieve full inclusion. Although the Ontario Ministry of Education (2000) stipulates that inclusive education must meet the needs of individual children (Young & Levin, 2002), the environmental pre-requisites for effective social and physical inclusion for disabled children remain unknown (Hemmington & Borell, 2002). Similarly, little is known about how classrooms and other school environments affect children with differing physical capacities and needs (Schenker, Coster & Paruch, 2005; Prellwitz & Tamm, 2000). These knowledge gaps are significant because built environments, assistive technologies, rehabilitation interventions and educational strategies may inhibit rather than enhance the movement capabilities of disabled children. Hence, their physical health, social abilities and cognitive development may be jeopardised (Kyttä, 2004; Broaders et al., 2007; Cook et al., 2008).

In this paper, key studies from neuroscience, pediatric rehabilitation, ecological psychology, architecture and education are reviewed to determine current understandings of children, their movement, and their interactions with physical features of everyday environments. Based on identified theoretical and methodological shortcomings, a novel framework is proposed for reconceptualising, observing and analysing children's 'body-environment' interactions in an integrated kindergarten classroom. The proposed framework accentuates the indisputable link between movement and optimal learning outcomes, and addresses the need for descriptive, naturalistic research about children and their environments. The paper concludes with important implications for the proposed research.

Key interdisciplinary studies

For the purposes of this review, movement is defined as: (1) *motor activity:* the physical activity of an organism as a behavioral phenomenon; (2) *physical play:* activity that is 'purposeless' in nature and occurs in unstructured contexts with minimal adult constraint; (3) *explorative movement:* movement that is information and goal directed but often co-occurs and interchanges with physical play; (4) *unrestricted or unstructured activity:* movement that is minimally constrained by physical and/or social variables; and (5) *gesture:* a class of co-ordinated movements involving the body or parts of the body to achieve some end, such as communicating or expressing an idea or emotion.

Recent neuroscientific evidence has strengthened the premise that movement and cognitive function are fundamentally related. Until very recently, the prefrontal cortex (critical for cognitive processing and learning) and the neocerebellum (critical for motor skills and actions) were not thought to communicate or participate in similar functions. Advances in functional neuroimaging (fMRI) have identified a neuronal link between these two brain regions. Imaging studies indicate that an increase in prefrontal activation during a cognitive task increases cerebellar activity, and that these regions are most active when tasks are novel or when conditions change (Diamond, 2000; Kelly & Strick, 2003). Other research has shown that movement deficits are evident in children with specific language disorder (Hill, Bishop & Nimmo-Smith, 1998). Collectively these findings support the need for further research that examines the relationship between children's movement and their ability to learn.

German investigators have elucidated some of the neurophysiological mechanisms underlying movement and cognitive function. In a study involving 27 healthy young adults, findings indicated that short bouts of intense physical activity resulted in elevated brain derived neurotrophic factor (BDNF) serum levels (Winter et al., 2007). BDNF is a protein and member of the neurotrophin family of growth factors. It is active in the hippocampus, cortex, and basal forebrain, areas vital to learning, memory, and higher thinking. It is also believed to contribute to synaptic efficacy, neuronal connectivity and brain plasticity (Vaynman, Ying & Gomez-Pinilla, 2004). Using a randomised cross-over design, investigators showed that sustained BDNF levels during learning after intense exercise were related to better learning speed and short-term retention of new information acquired during a complex cognitive task.

Neuropsychological research has established a strong association between children's use of gesture and improved learning (Cook et al., 2008). Using a pre/post-test design, third and fourth grade children were randomly assigned to one of three conditions: speech (no gesture), gesture (children were asked to move and produce hand gestures that displayed a strategy for solving a math problem), and gesture and speech. Children who used their hands to learn a new concept retained 85 per cent of their post-test gains four weeks later compared to 33 per cent for children told to speak and not gesture. In a similar study, Rowe and Goldin-Meadow (2009) associated infants' use of gesture (elicited by a parent's use of gesture) and increased vocabulary upon entering kindergarten, a key predictor of school success. Though the mechanism remains unclear, findings from both studies provide strong evidence that gesture may play a causal role in knowledge acquisition and retention. Researchers speculate that gesture constitutes an embodied way of representing new ideas that requires relatively little effort to produce, and thereby frees the brain's resources for encoding new information in a more lasting format (Cook et al., 2008).

In light of these findings, renewed scientific interest in the relationship between physical environments (defined herein as both built and natural environments), the movement opportunities they offer, and children's physical, social and cognitive development is warranted. Although the studies presented here utilise a range of conceptual and methodological strategies, they are clearly linked in their attempt to grapple with the inherent complexity of this relationship. Key studies that focus on how children move and play in natural, planned, and risky (outdoor) environments are reviewed in conjunction with research that focuses on built (indoor) environments such as school classrooms. Children's 'body-environment' interfaces are then critically examined within the context of childhood disability.

Outdoor environments

Most research concerning children's movement and the physical environment has been conducted in outdoor play environments. Fjørtoft (2004) conducted a quasi-experimental study with two Norwegian kindergarten classes that played in either a nearby forest or a traditional outdoor playground. Children in the experimental group encountered a shifting and challenging topography that encouraged physical exploration and play activities such as throwing pine cones, jumping and sliding off rocks, and climbing trees. Children in the control group played with standard, playground equipment that offered minimal physical challenge and opportunities for exploration. Drawing on developmental and ecological theories, Fjørtoft concluded that children who play regularly and independently in natural environments reap many health benefits including improved motor ability.

In contrast, Parish, Rudisill and Onge (2007) hypothesised that playing with specified equipment and receiving corrective feed-

back from teachers in a mastery-oriented, high achieving climate increases children's motivation and physical activity, and improves their motor skills. African American toddlers participated in a mastery-oriented physical play session and an unplanned free play session. Mastery session activities included hitting balls with sticks, riding scooters and balancing on a variety of static and moving objects. During the unplanned session, children were expected to locate equipment and create their own play experiences. Using heart rate as an outcome measure, results indicated that children were more active during the mastery session. However, only four of the 21 participants were monitored, and the limited unplanned play environment (purposely devoid of play equipment) may not have revealed children's true abilities to find and use non traditional objects to facilitate their play.

Kyttä identified an intriguing relationship between children's movement and their access to, and discovery of, environmental resources in two diverse geographical settings (2004). Drawing on James Gibson's theory of affordances (1979), she determined that a 'Bullerby' or 'noisy village' type of environment that abounded in Finnish communities offered 8 and 9-year-old children more movement independence and opportunities to perceive, use and shape environmental affordances. Gibson's central concept of affordance (discussed in more detail shortly) accounts for the fact that perceptual experience includes not only an awareness of the structure of objects and events in the environment, but also an awareness of their functional significance (Heft, 1988). Sandseter (2009) showed the degree of 'mobility license' (Kyttä, 2004) tolerated by adults was also an important factor in predicting children's ability to perceive and use affordances, and that adults rather than children perceived certain affordances as risky. Findings from both studies suggest that social affordances may also shape children's independent exploration of everyday environments.

Canadian researchers Cornell et al. (2001) found that the happenstance and wonder of adventure associated with moving independently in outdoor environments provided a natural opportunity for children to improve their analytical and strategic thinking. Two groups of children (aged 6 and 12 years) participated in an independent way-finding task that involved risk, strategy and adventure. The investigators reported that children's problem solving was not related to discrete stages of cognitive development. Instead, children made gradual improvements in speed, created new strategies, and returned to old strategies, suggesting that the acquisition of knowledge may be continuous rather than step-wise in novel and challenging situations (Siegler, 1996).

Adventure in the form of stimulation-seeking may also affect learning. Key findings from an American prospective longitudinal study suggested that increased stimulation-seeking in 3-year-old children is associated with increased cognitive, scholastic and neuropsychological test performance at 11 years of age (Raine et al., 2002). Although the mechanism remains unclear, researchers provided four possible explanations: (1) children who physically explore their environment and verbally interact with others create an enriched, varied and challenging environment; (2) highly active social play and goal-directed exploration of the environment facilitates cognitive function; (3) sensation-seeking children are physically active and it is activity, *per se*, that affects cognitive ability; and (4) inherent brain differences contribute to curiosity and lead to stimulation-seeking behaviour.

Indoor school environments

Research about school environments largely has been concerned with the symbolic meaning of particular spaces, and the pedagogical, psychological, and social variables that influence behaviour (Martin, 2006). Surprisingly little research has examined the

relationship between the physical features of indoor environments and children's movement, and thus how children learn. This may reflect the traditional assumption that movement at school should be tempered for optimal learning to occur. Studies presented here represent the limited research that links the architectural features of school settings thought to affect children's movement, and thereby their physical, social and cognitive development.

In an early study, Moore (1986) investigated the effects of spatial definition (i.e. degree of enclosure, proximity to circulation) on 2- to 6-year-old children's cognitive and social behaviours (i.e. engagement, physical exploration, social interaction) in 14 American child care centers. Drawing on environment-behaviour interactional theory that emphasises the physical environment rather than the social-structural properties of settings, he concluded that architecturally defined behaviour settings are significantly related to increased social interaction and exploration in these settings.

Tanner (2000) studied the relationship between school architectural design factors and student achievement scores in 44 American elementary schools. Clearly defined, expansive pathways that allowed 'freedom of movement' among structures, classrooms and other buildings were associated with high student performance scores in reading and mathematics. A lack of expansive pathways was associated with higher density and other restrictions on learning, and resulted in decreased attention spans, lower task performance, behavioral problems and social withdrawal. Papatheodorou (2002) described English elementary school children (aged 11 years) as 'contained' in an overcrowded environment that restricted their ability to be actively involved in the learning process. Findings revealed that certain physical environments transmitted negative messages about what activities should be taking place, and that play equipment/areas did not provide opportunities for social activity or physical experimentation.

Finally, Lanningham-Foster et al. (2008) compared physical activity levels of grade four and five children in a traditional, American classroom with desks and chairs, a modified traditional classroom with desks that encouraged standing, and an activity-permissive classroom where children were encouraged to move about during lesson plans. Known as the Neighbourhood, the activity-permissive classroom resembled a 35,000 square foot 'village square' complete with standing desks, miniature golf, basketball hoops, indoor soccer, and climbing mazes. Triaxial accelerometers were used to measure students' physical activity in each environment. A 50 per cent increase in physical activity was detected in the Neighbourhood, which indicated that children were as active in this environment as similarly aged children on summer vacation (when the activity-restricting effects of school are absent).

Physical environments and children with physical disabilities

Although physical environments can potentially facilitate movement, they can also exacerbate intrinsic movement restrictions in children with disabilities. Hence, there is a strong imperative to identify the physical features of everyday environments that enhance or inhibit their ability to move. Current research has confirmed that disabled children's movement fluctuates across different types of settings, and that contextual features influence their ability to function, explore and play freely in physically independent ways. For example, in a randomised controlled trial (RCT) involving children diagnosed with mild CP, Dutch investigators Ketelaar et al. (2001) reported that children (aged 2 to 7 years) who moved and solved motor problems independently in daily environments showed greater improvement in their performance of functional activities compared to a control group who strengthened normal patterns of movement in a controlled setting. Other research indicates that success and motivation associ-

ated with powered mobility (ie use of wheelchairs) may enhance children's motor abilities and explorations (Bottos et al., 2001), and thereby their ability to learn.

In Canada, Tieman et al. (2004) conducted a prospective longitudinal study based on interaction theory, and examined the capability and performance (what a child *can* do and what a child *does* do) of children diagnosed with CP (aged 6 to 12 years) in home, school and outdoor settings. Drawing on parent reports and standardised measures (i.e. Gross Motor Function Measure, GMFM) researchers demonstrated that children with similar capabilities performed differently across settings. Rigby and Gaik (2007) supported these findings in a pilot study that examined playfulness in disabled Canadian children (aged 4 to 8 years) in the same three settings. The results of both studies indicated that children were most mobile/playful at home and least mobile/playful at school. Further research is needed to identify the contextual features influencing children's ability to move freely in these settings.

Very few playgrounds are designed to be accessible to children with restricted mobility. Prellwitz and Tamm (1999) found that Swedish playgrounds were not built to be accessed by disabled children without the help of adults, which potentially put their social development at risk. In a follow-up study (2000), disabled students (aged 7 to 12 years) identified physical features of a classroom that inhibited their ability to move around freely, and curtailed their opportunities to choose friends. Shortcomings included a lack of space in the classroom for maneuvering wheelchairs, and 'difficult to get out of' adapted chairs that prioritised functional sitting above social interplay.

Holt (2004) studied physically disabled children in mainstream school settings. Partial findings from this in-depth qualitative study of two 'physically inclusive' English primary schools suggested that physical spaces have the potential to 'contain' disabled children and facilitate continued exclusion. She argued that although many mainstream schools espouse a philosophy of social inclusion rather than physical integration, the physical setting itself can perpetuate able/disabled binaries by architecturally segregating children, demarcating them as 'other', and intensifying normative underpinnings of primary school education. Findings accentuate the complex relationship among children, their movement and school settings.

Conceptual and methodological shortcomings

Collectively these studies suggest a positive link between physical and cognitive development and the ability to move and explore independently in indoor and outdoor environments. While researchers have clearly begun to grapple with the theoretical and methodological issues associated with understanding the dynamic interplay between moving bodies, physical environments and children's ability to learn, the existing literature continues to raise issues and pose questions that are difficult to answer within a predominantly experimental paradigm. Invariably there are certain kinds of problems and problem solving methods that fall beyond the boundaries of any paradigm. As such, a non-dualistic framework is needed to understand the *reciprocity* between children's bodies and the physical characteristics of built environments.

With some notable exceptions, researchers have primarily used quantitative and standardised measures to determine *how much* children move rather than *how* they move, and as such have provided limited descriptions of physical environments or the movements they restrain or enhance. Privileging movement *or* the environment within a dualistic framework excludes alternative methods of inquiry that may ultimately be more compatible with the question posed. Furthermore, most research has been based on the observations of researchers, health professionals, parents, caregivers and teachers. Hence, children's own detailed views of *how* and *why* they move in certain

ways in particular environments often remain unknown. Finally, very few studies describe how individual children's characteristics (i.e. gender, size, physical abilities) affect their movement interactions.

Frequently, traditional theories of child development have been used to sample and/or group children in age-related categories, however they are rarely applicable to disabled children. Furthermore, these theories diminish children's competencies, neglect variation in development, minimise the effects of differences such as gender, social class and ethno-cultural background (Christensen & James, 2000), and inadequately focus on the physical aspects of environments (Moore, 1986; Papatheodorou, 2002). Developmental theory also underpins biomedical models of disability that cast impaired bodies as lacking in function rather than as capable of a range of physical possibilities, and perpetuate able/disabled dualisms. Hence, only tentative claims can be made about how these children experience their bodies and actualise environmental affordances, and how physical spaces enhance / inhibit their ability to move.

Finally, most research has focused on the movement of school-aged, non-disabled children in outdoor environments. To our knowledge, no research has been conducted with integrated pre-school/kindergarten children in classrooms or school settings. This is not surprising since the classroom traditionally has been intended and has been perceived as a place of 'physical order' where children learn to move in regulated and practiced ways (Foucault, 1975). However, recent neuroscientific evidence has strengthened the premise that movement and cognitive function are fundamentally related.

The body-environment interface: A new conceptual framework

In attempt to address these gaps and re-situate current knowledge, we propose a non-dualistic framework for re-conceptualising the 'body-environment' interface, where neither the body nor the environment is given primacy. Rooted in two different but compatible domains, children's bodies are conceptualised according to Gilles Deleuze's philosophical premise that any body's potential is unknown until it is allowed to demonstrate 'what it can do' (Deleuze, 1988), and an integrated kindergarten classroom environment is conceptualised according to James Gibson's ecological psychology and theory of affordances (1979). Finally, we propose a novel methodological strategy for observing and analysing children's movement.

Children's bodies: A Deleuzian perspective

Considering the physicality of children from the typical dualistic foundation that positions the mind as the locus of knowledge reflects the binary thinking that permeates Western medical and educational systems. This view is inconsistent with new thinking that conceives the mind as deeply rooted in bodily action and interaction (Garbarini & Adenzato, 2004). Drawing on ideas inspired by Spinoza and developed by the late contemporary philosopher Gilles Deleuze, we propose a new framework that considers the nature of the child a philosophical problem and rejects the privileging of mind over body. Guided by an ontology that seeks to 'unsettle' rather than 'settle' old questions, this framework ruptures traditional understandings and focuses on 'what a body can do' (Spinoza, 1677; Deleuze, 1988). As such, disabled and non-disabled children's bodies are cast as 'sources of knowledge' (Deleuze, 1988, p.47) replete with physical capacities.

Viewing the body as the sum of its capacities rather than reducing it to its functions (Buchanan, 1997, p.75) rejects the subordination of the body to the intellect, and extends it beyond the given conditions of knowledge. Describing 'what a body can do' as opposed to 'what a body is' (Spinoza, 1677; Deleuze, 1988) locates the body as a source of knowledge in terms of its capacity to form specific relations with objects, persons and spaces (Buchanan, 1997, p.80).

Locating the body as a source of knowledge avoids categorising children as non-disabled or disabled, which establishes external differences and perpetuates able/disabled, perfection/imperfection binaries.

According to Deleuze and Guattari (1987) it is possible to know bodies differently through the identification and creation of 'smooth spaces' or 'consistent planes'. This knowledge is in 'excess' of mainstream medical, educational and social understandings (Hickey-Moody, 2006). Through inventive connection, an 'unclasping' (Deleuze & Guattari, 1987, p.326) can occur where various categories (or strata) such as physical ability can be disrupted. For example, 'potential movements of deterritorialisation or possible lines of flight' (p.161) may be observed as children attempt to 'smooth out' or destroy categorical gridding, escape their physical limitations, and affect, act and interact with/in the classroom environment.

To become a new body, new milieux through which to move need to be identified (Massumi, 1992, p.98). Hence, we will observe *where* children are able to 'unhinge themselves from habit, and break stimulus-response circuits'. Massumi describes these places as cracks, or 'zones of indeterminancy' that can be filled with potential and unpredictable bodily responses. Identifying how children access or create these zones may lend insight into how children 'unleash' themselves (p.101) to discover unknown physical possibilities. Since the bodies of disabled children are often described as lacking and not imagined to articulate a range of potentialities, we will respond to Hickey-Moody's invitation to re-imagine their corporeal capacities in this classroom (Hickey-Moody, 2006).

Children and the classroom: A Gibsonian perspective

To conceptualise the integrated kindergarten classroom, we draw on ideas and existing research from the field of ecological theory to observe transactions between children and an *indoor*, physical environment. The central feature of the ecological approach is the notion of reciprocity, whereby people engage with physical environments to learn more about their properties, and selectively enter places to learn from, benefit and modify the functional opportunities they offer (Heft, 2001, p.xxiii). It is based on the assumption that environments are inherently discoverable and can be immediately experienced (James, 1909/1978, as cited by Heft, 2001, p.31). It follows that people and environments are not cast as discontinuous entities; hence people are said to experience environments through their bodies.

Casting the environment in this relational manner provides the groundwork for James Gibson's theory of affordances. 'Affordance' is a central construct of ecological perceptual psychology, and affordances are considered to be the physical opportunities an organism perceives in specific settings (Gibson, 1979). In that affordances point both to the environment and to the observer, they are neither objective nor subjective properties. The environment must provide something that is perceived as offering potential for activity, but this perception emerges only when different characteristics of the person, such as size, gender, abilities, social needs and intentions are matched with environmental features (Kyttä, 2004).

The *potential* affordances in any environment are said to be infinite, whereas *actualised* affordances (Heft, 1989) are those that a person perceives, utilises, or shapes (Kyttä, 2002). As a result, effective environments are established relationally, and can be described according to the physical opportunities they offer rather than their form. For example, a bench as perceived by a young, physically agile child may be balance-on-able, while a disabled child may actualise the object's hide-behind-able or crawl-underneath-able features (Gibson, 1979; Heft, 1988). Similarly, a railing can become the very signal of movement, inviting a particular child to physically experience its swing-on-able or slide-down-able features.

Children's performances: Theory to method

Drawing on the Deleuzian/Spinozist claim that the body is a source of knowledge (Spinoza, 1677) and the Gibsonian belief in the experiential primacy and reciprocity of 'real world' settings (Heft, 1988), we have designed a focused ethnography to capture children's creative exploration and new bodily actions, the discovery of features never encountered before, and the actualisation of environmental affordances (Kyttä, 2004; Heft, 1988). Observing how children *perform* as extensions of the space and how the space serves as an extension of their physical performances reconfigures the body-environment relationship, and accentuates the dynamics of the physical milieu (Perez de Vega, 2007; Heft, 1988). Children's bodies gain significance when they become active through external connections, through what they can do, ie through performance. As the environment ceases to be considered a mere container for the body and becomes an element of performance that includes the body, a new relationship is said to emerge (Perez de Vega, 2007).

Rudolf Laban, a mid-20th century pioneer of modern dance, believed that everyday behaviour is ruled by the art of movement (1948). Drawing on a keen sense of observation in many movement contexts, he noticed children's 'innate urge' to perform dance-like movements (1948), and developed a system capable of distilling the features that constitute movement actions (Bartenieff, 1980). As such, his movement analysis techniques (LMA) offer a rigorous way to describe, interpret, and document children's performing bodies in relation to the classroom environment. By determining what part of the body is moving *(Body)*, how the body is moving dynamically *(Effort)*, where in space the movement occurs *(Space)*, and how the body relates to the environment *(Shape)*, the ecological and performative interaction between children and a 'real world' setting will be captured in a novel and in depth way. Furthermore, LMA provides a strategic tool for linking and operationalising our conceptual domains. Describing children in *concert* with the environmental affordances they encounter has the potential to reconfigure dualistic notions of body-environment interfaces, disrupt traditional mappings of disability (Hickey-Moody, 2006), and address gaps in knowledge concerning built environments and their impact on how children learn, their physical health and social abilities, and their cognitive development.

Conclusion: Research implications

A non-dualistic framework is proposed for studying children's 'body-environment' interfaces, where neither the body nor the environment is given primacy. To this end, a study rooted in two different but compatible domains has been designed to accentuate the dynamic interplay between children's bodies and the physical characteristics of a kindergarten classroom. Child-and disability-friendly ethnographic methods consistent with the proposed theoretical underpinnings will be used to: (i) describe classroom objects, features and pathways according to the functions they afford children; and (ii) analyse children's movement using Laban Movement Analysis techniques. Data will be integrated to produce a *superset of affordances* and a *movement profile* for each child. Profiles will be analysed and grouped to determine how differences such as physical size, ability, proximity and access to environmental affordances, social attitudes towards disability, gender and culture enhance or inhibit children's movements.

Research that examines the relationship between children's movement and their physical environments in a conceptually novel way has implications and directions that have the potential to effect the movement of all children. Our findings may contribute to knowledge about environmental features that enhance or inhibit children's movement capacities. This may have design implications for not only mainstream and inclusive school environments,

but also for clinical, therapeutic and hospital environments where children are assessed and/or treated.

Our findings may have implications for how children are educated, and may challenge traditional ideas about the classroom. Recent neurological evidence suggests that the goal of 'physical order' (Fielding, 2000) and the notion that children learn best when sitting still may be jeopardising their ability to learn. Our findings may motivate both teachers and health care professionals to rethink the ways in which they inspire children with and without disabilities to move, and about the effects of strategies and interventions that temper or enhance this movement.

In that this research may ultimately offer an alternative way of understanding body-environment interfaces, there may be important implications for existing and future research that grapples with similar questions and methodological issues. Rethinking experimental designs and methodologies within a non-dualistic framework may lead to new strategies that emphasise the reciprocity between children and their environments, and disrupt ways of knowing that perpetuate able/disabled, mind/body, body/environment dualisms. For instance, a non-dualistic approach may reveal the physical capacities of disabled children who demonstrate 'what their bodies can do' when they creatively actualise a wheelchair/smooth surface, and thereby enhance their speed, maneuverability, agility, and ability to take risks.

In summary, our findings could contribute to a reconceptualisation of children, their bodies, and their 'body-environment' interactions, such that we may 'come to know possible bodies such as have never been seen before' (Massumi, 1992, p.101). Ultimately this knowledge could be used to optimise: (1) environments that support children's fundamental right to access and move freely within them; (2) the development of their physical, social, and cognitive capacities; and (3) environmental, educational and rehabilitation interventions that encourage children to explore, navigate and shape their everyday environments.

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Built-in: Meaning and the reproduction of socio-historical characteristics in public schools buildings in the US

Valkiria Durán-Narucki

The aim of this article is to prompt thinking about the complex role of the built environment of the school to academic outcomes and to the reduction of social disparities. To this end the paper explores the issue of the condition of public school buildings expanding from traditional empirical research to include a socio-historical perspective. The benefits of using ecological psychology are described in conjunction with socio-historical analysis to understand the role of the built environment of the school in academic outcomes.

Inspiration for this paper comes from the work of the author's advisor and mentor, Susan C. Seagert.

SCHNEIDER (2002), in his review of the literature on the impact of educational facilities on academic outcomes, concluded that: *'School facilities affect learning. Spatial configurations, noise, heat, cold, light, and air quality obviously bear on teachers' and students' abilities to perform'* (p.17). Empirical research has shown with some certainty that specific aspects of the physical school environment affect the performance of its users. Specific variables have specific effects on learning. Less is known, however, about the impact of school building as a whole. For example: How does the whole building function as a socio-physical-historical unit in terms of the daily routines of its users and how does it influence academic outcomes?

The settings in which we spend time are complex social units embedded in, and affected by, different levels of social organisation (Bronfenbrenner, 1979). The public school building, as the main setting where the education of many takes place is also deeply and specifically set within many social forces that determine its quality. The condition of the school building is not a symbol of the social characteristics of the town or city where the school is located; it is an indicator of them.

It is from this perspective that the features of the physical environment of the school are relevant to understanding of how school buildings contribute to the education of children. School buildings may inform their users about behavioural expectations and set the tone for what can and cannot occur within its walls (Durán-Narucki, 2008). This is done not only through obvious building features such as layout or architectural style, but also through the cleanliness of the school, the building materials used in the school, the presence of symbols (flags, emblems, etc.), the available spaces, the condition of these spaces, and other more or less intentional and/or permanent elements. Building features speak of social practices past, present and future and determine the nature of these practices.

It is, therefore, necessary that researchers and practitioners in psychology and education move the discussion about the condition of school buildings from establishing whether school building condition affects academic achievement, to how is it that school building condition affects academic achievement. The traditional cause-effect model where bad schools engender bad school outcomes must be modified to explore school buildings as intimate partners in daily transactions that may or may not contribute to academic achievement. In the investigation of the role of school build-

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ings in education, models that include social and historical variables should be generated and tested. The goal is to clarify the role of the different factors that both produce the conditions in the school building and the educational outcomes by bringing a socio-historical perspective to the research on school building condition.

School buildings as co-creators of meaningful transactions

The transactional world view, originally described by Altman and Rogoff (1987) understands psychological phenomena as holistic events composed of inseparable and mutually defining psychological processes, physical and social environments, and time/change. This perspective promotes the complex conceptualising of school buildings in that the actions of one person are understood in relation to the actions of other people and in relation to spatial, temporal, and situational circumstances. It is in the relational qualities that school events are defined, not in the characteristics of its elements (or variables) considered as independent units (Altman & Rogoff, 1987). From the transactional perspective, the physical environment of the school is not the background or the enabling surface for behaviour to occur; it is an integral part of any activity that occurs in the building and its quality.

An application of this perspective is exemplified by projects that directly use building features to teach students. Some school buildings are designed using alternative energy sources or energy conserving features that allow students to interact with them and learn about these ways to produce energy (Smith, 2010). However, an implication of the transactional perspective is that all planned or not planned features of the built environment of the school are constantly interacting with school users and, therefore, creating and recreating meaning. What kinds of meanings do these interactions produce? What kinds of behaviours, thoughts, or feelings do these interactions create and maintain? And more specifically, what do outdated, dirty, broken, too empty or too full buildings communicate to their users?

Environmental meaning is consequently a useful concept with which to analyse how school building quality interacts with different school users to produce different outcomes. The definition espoused in this paper is the one described by Harry Heft in his book *Ecological Psychology in Context* (2001). Heft states that environmental meaning is the sociocultural information embodied in the physical world. Meaning is intrinsic to the structure of the environment. Individuals gain an understanding of a common, meaningful environment from the intrinsic, structural relations provided by environmental information. The study of meaning has been avoided in psychology because of its historical affiliation to mechanistic views of science. From an ecological perspective, the meaning of a setting resides in the existing structure of the environment in relationship to who is perceiving it. (for a thorough explanation, see Heft, 2001). Heft proposes that environments are intrinsically meaningful and, therefore, offer a *'public and shared repository of knowledge'* (Heft, 2001, p.369). People align their actions based on their readings of environmental meaning. Meaning is, therefore, relevant to the study of environmental transactions in school settings because of its capability of aligning individuals' actions when entering a setting (like the school) with the setting's functional character (learning).

So far this article has highlighted the close relationship between school buildings and school users and how school outcomes can be a product of this relationship. The poor condition of public school buildings is, nevertheless, a widespread and important problem both in the UK where 'the many overglazed, poorly insulated and often porous buildings of the 1960s and 1970s often have high running costs and unless well maintained do not provide the learning and working environments required today.'

Sorrell (2005) and in the US where the National Center for Education Statistics found that one in four schools in the country reported that at least one type of onsite building (i.e. original and temporary buildings, permanent additions) was in less than adequate condition. These schools were more likely to be located in central cities and had the highest concentrations of poverty (US-NCES, 1999). The condition of school facilities and its role in the production of academic success is an issue not only of aesthetics, functionality or health, it is also an issue of social justice. Public schools as places where the larger society invests in the education of the next generations need to be places where students have access to the tools of social mobility. Horace Mann's ideal of public schooling as 'the great equaliser' (Cremin, 1957) becomes bogus at best when children attending public schools in districts with higher income receive a qualitatively different education than those children attending schools in lower income districts. The consistent pattern of inequality in the provision of quality education disenfranchises the most vulnerable.

The reproductive nature of the physical environment

The role of school facilities is relevant to educational psychologists because the daily transactions between school users and their building affect education and learning in specific ways. The consequences of these transactions may benefit school outcomes (grades, attendance, drop-out rates, etc.) in a positive or negative way which in turn that may reproduce the sociocultural situation in which the school exists.

In order to understand how the characteristics of the school setting reproduce the existing sociocultural order it is necessary to include at this point Pierre Bourdieu's analysis of everyday life (1972, 1977, 1990). In his thesis Bourdieu analyses the allocation of power in the everyday life of people. His perspective puts forward the view of the school as a transactional field where person-environment units interact, adding that these interactions are socially determined by historical processes.

Bourdieu developed the concept of 'habitus'. Habitus is defined as a system of lasting and exchangeable 'dispositions' or acquired schemes of perception, thought, and action (Bourdieu, 1972). The person develops these dispositions in relationship with structures such as class, family, education and the environments they encounter. The learning of an individual person's location in society is done seamlessly through his or her socialisation and, therefore, often goes unnoticed and unquestioned. It helps individuals to adopt the established practices of their social group (Nash, 2005). The habitus is a helpful concept relevant to the understanding of school buildings as reproducing social characteristics because it mediates between 'objective' structures of social relations and the individual 'subjective' behaviour of people. Bourdieu proposed that socialisation is seen as the embodiment of social structures and, therefore, reproduces the characteristics of the social group in which it occurs. It is easy to understand how this happens as schools tend to match the demographic and socioeconomic make up of the community in which they are located. Students learn the values and behaviours of their social group and are inclined, therefore, to continue as members of this group. It follows from this that students attending schools in high income communities will tend to join that higher income bracket and students attending schools in lower income communities will likely do the same. Consequently the social structure that creates and maintains a specific type of school also reproduces its characteristics through the socialisation of its users. The social structures in which individuals are implicated are at the same time maintained by those individuals through the historical re-enactment of social relationships and the exercise of power. This is how everyday life can both display and mask social meaning and status in school buildings.

The specific role that the physical environment of the school plays in this process is described by ecological psychology (Heft, 2001). A large amount of what people know is already in the environment. The transmission of cultural knowledge cannot occur merely by direct social contact. In order to preserve knowledge through several generations this knowledge must take a shape that is 'extra-somatic' or outside of the body (Ingold, 2000). Heft refers to this as *'ecological knowledge, durable tools and artefacts that have information relevant to some task built into their structure and the creation of means to express information symbolically in such a way that can be preserved in some relatively durable form as a representation'* (Heft, 2001, p.340). The emphasis is on the discovery of environmental structure, rather than on the imposing of mental structure on the everyday world

Placing the acquisition of knowledge in the interaction with the environment, Heft and Bourdieu agree that capital exists in the environmental transactions that people carry. Indeed, Bourdieu initially conceived the notion of cultural capital in order to explain the 'unequal scholastic achievement of children originating from the different social classes' (Bourdieu, 2001). The study of schools as reproducing social inequalities is also a study of how cultural capital is transmitted.

This is a useful notion to explore as it describes the everyday life of a school linking structural analysis to shared practical knowledge. In the case of schools, everyday pedagogic action leads to cultural reproduction and ultimately to the reproduction of underlying power relationships (Bourdieu, 1990). Habitus is a concept central in the reproduction of social inequality because it highlights the automatic nature of the mechanisms that maintain a societal order. Once the members of the less privileged classes enter the struggle for status, the differences in habitus make for an unequal fight and hence for the reproduction of inequality. That inequality is both the medium and the outcome of their practices (Baert, 1998). Schools as social institutions can sustain the symbolic wealth without agents having to recreate it constantly (Bourdieu, 1990). This removes the focus of the power struggle between individuals and places it in the larger realm of social interactions in situ.

Conclusions

The previous sections aims to demonstrate that the quality of school facilities and their impact on academic outcomes should be studied using a complex theoretical approach. The transactional paradigm which understands behaviour in relation to people, spatial, temporal, and situational circumstances, and defines events in relational terms is such an approach. The quality of school facilities is intimately related to the quality of the behaviours, thoughts and social interactions that take place at a school.

In addition, the study of school buildings' impact on academic outcomes need to give recognition to the fact that the distribution of quality in educational facilities is not random. The unequal distribution in the funding of public schools, the socio-economic characteristics of the communities where the schools are located, as well as the sociocultural practices of the members of those communities, will interact with school quality to produce academic outcomes. Through socialisation schools will reproduce and maintain the existing social order of each community, limiting in many cases the agency of individuals.

The view of schools as complex socio-historical entities deepens the understanding of the role of the built environment of the school. Researchers and advocates for the improvement of school building conditions have concentrated their efforts in proving that the quality of the physical environment of the school affects students' academic outcomes. This article aims to point to the logical next step, which is generally unstated, but assumed: the quality of schools buildings contributes to the reproduction of social inequalities.

The problem of school facilities in disrepair is not circumscribed by the quality of the physical environment. It also lies in the intricate set of person-environment transactions that is fostered and that, by its own nature, reproduces the social structure that supports it.

Money spent on public education is always the object of scrutiny as it constitutes the largest percentage of the expenses of local government. Disputes arise when decisions are made on how to spend finite funding in the most efficient manner. There is, however, little debate as to whether good facilities contribute to education. Given the impossibility of financing all school improvements, renovations, or new buildings, it is important to establish some guidelines about what aspects of the physical environment would improve the daily transactions of school users. Further research is required to establish the specific aspects of the building that directly impact academic outcomes. Furthermore, it is important to unravel the consistent correlation between ethnicity, socioeconomic status and the provision of adequate school facilities. The complexity that carries the understanding of the quotidian life of schools should be reflected in theory and praxis.

Finally, Robert Gifford (1987) described that students in a classroom can develop 'environmental numbness'. He did a small but interesting study where he found that students were very unlikely to move inhospitable furnishings to improve their movements in a room and diminish their levels of discomfort. The reasons for this acceptance of discomfort in daily life may be many and complex. It is important, however, for educational psychologists and other school practitioners to gain environmental awareness and manipulate their environments to fit personal and educational needs. Environmental awareness can contribute to increase the agency of teachers and administrators and create more welcoming and functional schools.

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Length

The main body of text in papers should usually be 3500–5000 words in length although papers outside this range may be considered at the Editor's discretion. Authors must indicate the word-length of papers with and without the reference section, excluding any tables or figures.

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Howitt, D. & Owusu-Bempah, K. (1999). Education, psychology and the construction of black childhood. *Educational and Child Psychology, 16*(3), 17–29.

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Optimal environments for learning: The interface of psychology, architectural design and educational practice

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