

WHERE SUSTAINABLE SCHOOL MEETS THE 'THIRD TEACHER': PRIMARY SCHOOL CASE STUDY FROM BARCELONA, SPAIN

Marta Brković*, Oriol Pons, and Rosie Parnell*****

* ARQubator, Belgrade, Serbia

** Barcelona School of Architecture (UPC), Barcelona, Spain

*** Sheffield School of Architecture, Sheffield, UK

marta.brkovic@gmail.com

Abstract

Participatory evaluation of aspiring sustainable schools and their pedagogical potential has recently come into focus. A few authors have made a significant start in examining schools as both environmentally and socially sustainable environments, which might simultaneously represent the 'third teacher'. However, discussion around this idea is new in Spain. This paper describes a participatory post-occupancy study conducted with teachers and pupils in Fort Pienc School, Barcelona, Spain. Findings reveal the pedagogical potential of the school's spaces and fabric, characterised as 'sustainable', and highlight the aspects that the research participants feel are performing and underperforming. The paper concludes that if we want sustainable schools to be a strategy for renovating the educational process and for leading us towards a better tomorrow globally and locally, new models for exploring the pedagogical potential of sustainable schools should be developed and the efforts of all relevant parties synchronised; from architects to governments, from pupils to teachers.

Keywords: *sustainable schools; the 'third teacher'; participation; post-occupancy*

INTRODUCTION

Faced with an ever-growing number of social, environmental and economic challenges, Wade and Parker (2008) stressed that we need to transform educational systems, because education has a central role to play in transforming our lives on the planet into more sustainable forms. Others like Gough (2005: 339) suggested that the "sustainable school is the most appropriate strategy for renovating educational processes and achieving quality education". According to the Department for Children, Schools and Families (2008: 6) "A sustainable school prepares young people for a lifetime of sustainable living, through its teaching, fabric and its day-to-day practices. It is guided by a commitment to care: for oneself (our health and well-being); for each other (across cultures, distances and generations); and for the environment (both locally and globally)".

Across Europe, there are examples of schools designed with sustainability in mind, aiming to reduce their impact on the environment. A small number of architects and researchers have gone a step further, aiming to use school design as a vehicle to raise awareness about sustainability issues, and stimulate children to explore the same (Newton, Wilks and Hes, 2009). These environments are founded on the principle that a school's spaces and built fabric can have an impact on, incite and even provoke learning, thus acting pedagogically as the "third teacher" (OWP/P Cannon Design, VS Furniture, and Bruce Mau Design 2010; Salama, 2009). Architects of those schools believe that "the curriculum embedded in any building instructs as fully and powerfully as any course taught in it" (Orr, 2002: 212).

Yet, even when schools are identified and labelled as 'sustainable', they usually address just the environmental dimension of sustainability. Although some architects believe that the school environment can act pedagogically as the 'third teacher', few authors have discussed how

teaching about sustainability principles can be embodied in the design of a school building. The pedagogical potential of sustainable schools is still under-researched and calls for a stronger empirical evidence base to support related practice. Participatory evaluation of such schools by teachers and pupils can provide a crucial part of this empirical picture (Khan and Kotharkar, 2012; Sanoff, 2008). Wishing to collect some more empirical evidence, develop new insights and suggestions for designing pedagogically valuable sustainable schools, the authors facilitated an evaluation of Fort Pienc (FP) school in Barcelona, Spain by teachers and pupils. The main novelty of this research is that it presents the first qualitative participatory post-occupancy evaluation of a school in Spain through the prism of sustainability and the ‘third teacher’.

LITERATURE REVIEW

Sustainable school as the “third teacher”

Relevant literature was reviewed in order to (a) develop an outline framework for understanding the ‘sustainable school as the third teacher’ concept; and (b) establish a set of sustainable school themes. This framework would in turn inform the design and analysis of the post-occupancy study. The literature review protocol determined that any publication would be included which in some form set out to describe what constitutes a sustainable school as the third teacher, with reference to the architecture and built fabric of the school environment. Relevant literature therefore included both evidence-based and practice-based studies.¹

Preliminary analysis revealed three sub-groups of literature. The discussion in the first group of studies focuses primarily on environmental sustainability issues; the possibility to reduce the environmental impact of schools. Such discussion is typically found in school design manuals that can help architects to apply the principles of energy efficient architecture, alternative energy sources, rainwater harvesting, recycled materials, cross ventilation, adequate combination of natural and electric light, etc. (see for example, CHPS, 2006; Targetzero, 2010; ASHARE, 2011).

The second group of studies consists of a number of examples that illustrate how school designs around the world were developed according to sustainability principles; again, mainly environmental. However, this group goes a step further and acknowledges the teaching potential of a school’s design and fabric. The UK’s Department for Education and Skills (2006: 9) observed that a building could be used as a “teaching tool”, while LPA (2009: 50) and Ford (2007: 6) suggested that sustainable schools could be “living laboratories” which can engage pupils and community in learning about environment and environmental stewardship on a daily basis. Gaia Architects (2005: 1) propose that sustainable school design should demonstrate and imbue in the learners awareness about sustainability issues. Additionally, Gelfand and Freed (2010: 248) argue that school facilities could be a vehicle for learning when environmental sustainability systems are visible; because transparent demonstration of sustainable behaviour has educational potential.

The third group of studies uses examples to illustrate how school design can respond to multiple sustainability themes (including and beyond the environmental), and, in addition, frames these with corresponding ideas from pedagogy. In order to inspire and provoke learning, for example, school environments should be rich in positive stimuli, initiate exchange of information, and provoke questions (Nair and Fielding, 2005). Schools should also support learning through discovery, investigation, exploration, experimentation and play (OWP/P Cannon Design, VS

¹ This paper draws upon research carried out by Marta Brković for a PhD at the University of Sheffield, School of Architecture, supervised by Prue Chiles and Rosie Parnell.

Furniture, and Bruce Mau Design 2010). According to Taylor (2009: 25) the physical environment of a sustainable school can be the “silent curriculum”, because the physical attributes of learning environments can be cues prompting learning. In this way, sustainable school buildings can be the best physical manifestation of good educational practice (Nair and Fielding, 2005).

Although a unanimous set of sustainability themes could not be identified, there was a core consensus, with a set of key sustainability themes appearing in the majority of studies. Following a process of coding, these themes were distilled as follows, reflecting the most common portrayal of the sustainability concept as a tripartite (Brković, 2013):

- social (safety and security; health; physical activity; food; sense of a community; participation; inclusion and equity; cultural diversity; sense of a place; education);
- environmental (school grounds; building construction and materials; light; ventilation, cooling and heating; water; waste and recycling; transportation; energy, new technologies); and
- economic (cost-effectiveness; operation and maintenance; new technologies and flexibility and adaptability).

This framework illustrates a broad set of agreed sustainability challenges to which every school should respond, according to the reviewed literature.

Sustainable schools in Spain

Today around five hundred schools declare themselves as “Green Schools” in Catalonia (Educational Department, 2012). Additionally, some schools have participated in the project “Creating Sustainable Schools” in order to raise awareness about sustainability through curricular and extracurricular activities (Etwinning, 2010). However, the majority of these schools address sustainability exclusively through their curriculum.

Between 2003 and 2013, thousands of schools were built in Spain using very tight time frames due to rapid rates of migration. This urgency to solve a lack of educational centers was the main reason for building new schools. During most of this period, Spanish building standards (2006) did not strongly advocate addressing sustainability issues through building design. Since 2010, Spanish school standards (Educational Ministry, 2010) and Catalan “Criteria for building new school edifices” (Educational Department 2001) have suggested including renewable energy sources, recommended reducing and managing construction waste, and proposed appropriate materials (Generalitat de Catalunya, 2006). Although, the lack of legislation in favour of sustainability is evident, there are some schools that have implemented the 2010 recommendations. To illustrate, Martinet Primary School, in Barcelona, has been designed to promote natural ventilation and reduce energy costs (Webecoist, 2011). The number of schools that use biomass is increasing (Biomass, 2011) and hundreds of schools have been built using off-site fabrication, lowering environmental impact during their production phase (Pons and Wadel, 2011). Some of these schools also use low impact materials such as wood (Bestraten and Hormias, 2009) and several schools were included as a part of a wider regional initiative to improve the energy efficiency of public buildings (European Commission Energy, 2012).

Additionally, Spanish sustainability assessment tools and methodologies are neither qualitative nor participatory. For example, VERDE is a quantitative tool not specifically intended for evaluation of educational buildings (Macias and Garcia, 2010); while MIVES (Pons and Aguado, 2012) is a quantitative methodology that has been developed by experts (architects, engineers and administrators) to assess the architectural technologies used to build the latest Spanish schools.

Challenges for the future

The application of technical and technological systems as a means to achieve environmental sustainability prevails in the discourse. Although technological solutions have contributed significantly to reducing the impact of schools on the environment, concentrating on this approach alone can lead to a fragmented approach to designing sustainable schools (Lippman, 2010: 1), ultimately neglecting the human factor in contributing to a more sustainable lifestyle. We need more research on how teachers, pupils and the other relevant users of sustainable school spaces are interacting with technical systems and, from these interactions, learn. Approaching the issue from another direction, the discourse around pedagogy, education and psychology as the basis for school design exists in a separate sphere to that around sustainable schools, with the two areas rarely engaging in dialogue.

There is a wealth of innovative ideas and experiments demonstrating how architectural design features could be used to support learning. Although the potential learning opportunities constituted by the physical fabric of a school are clear to see, very few of the relevant claims made have been supported by empirical evidence (UNESCO UIS, 2012: 58). Fischer (2005: 165) points out that “there is insufficient qualitative/deep research on the relationship between pedagogy and design of learning environments”. This is particularly true for schools designed with sustainability in mind, where pupils, teachers and other school users have rarely been engaged qualitatively in evaluating the environments that they inhabit. Clearly, a gap exists in the field between the literature on sustainable schools and that exploring schools as “third teacher”. This study begins to address this gap, offering one approach to bridging the pedagogical and the sustainable, through qualitative empirical research with school users.

RESEARCH AIMS AND METHODOLOGY

This study aims:

- to understand how teachers and pupils evaluate school design in relation to social, environmental, and economic sustainability themes; and
- to investigate how the architectural design of a school, has an impact on learning associated with sustainability issues.

These questions are examined through the prism of the sustainability themes identified through extensive literature review and analysis (see above), in the geographical and socio-political context of Spain.

As this study aims to better understand the ‘user’ perspective, a qualitative approach was chosen as an appropriate means to “document the world from the point of view of the people” (Hammersley, 1992: 165). The qualitative methods adopted here are framed as an opportunity to involve the research participants (school users) in supporting a “deeper understanding of social phenomena” (Silverman, 2008: 8); in this case, the use and inhabitation of sustainable schools as the ‘third teacher’. A case study strategy was adopted, offering the opportunity to build a rich picture of this phenomenon, in a particular context (Yin, 2008).

Setting

Fort Pienc primary school in Barcelona, Spain was chosen as the case study site. The most important criterion for selection was the architects’ intention and attempt to design a sustainable school in which the built fabric and design elements could be used for learning.

FP School is situated in the Fort Pienc neighbourhood in Barcelona’s Eixample district (Fig. 1). It is a public school which consists of a kindergarten (age 3-5 years) on the first floor, and a primary school (age 6-12) in the rest of the building. In 2006, the school moved into this building from a prefabricated one situated nearby. Today, with 3714m² it is a school for 500 pupils and 33 teachers. Together with a civic center, daycare, market, residence for elderly and library it forms the heart of the Fort Pienc community. As the whole neighbourhood lacked identity, big districts in

Barcelona were reorganised so that all the services were joined and used mutually in one community. The idea was that the school would use the civic centre facilities and vice-versa, in part to support a positive sense of community. The masterplan for the whole complex was designed by Josep Llinàs in 2000, with the school being designed later in 2005 by Pich-Aguilera Architects.

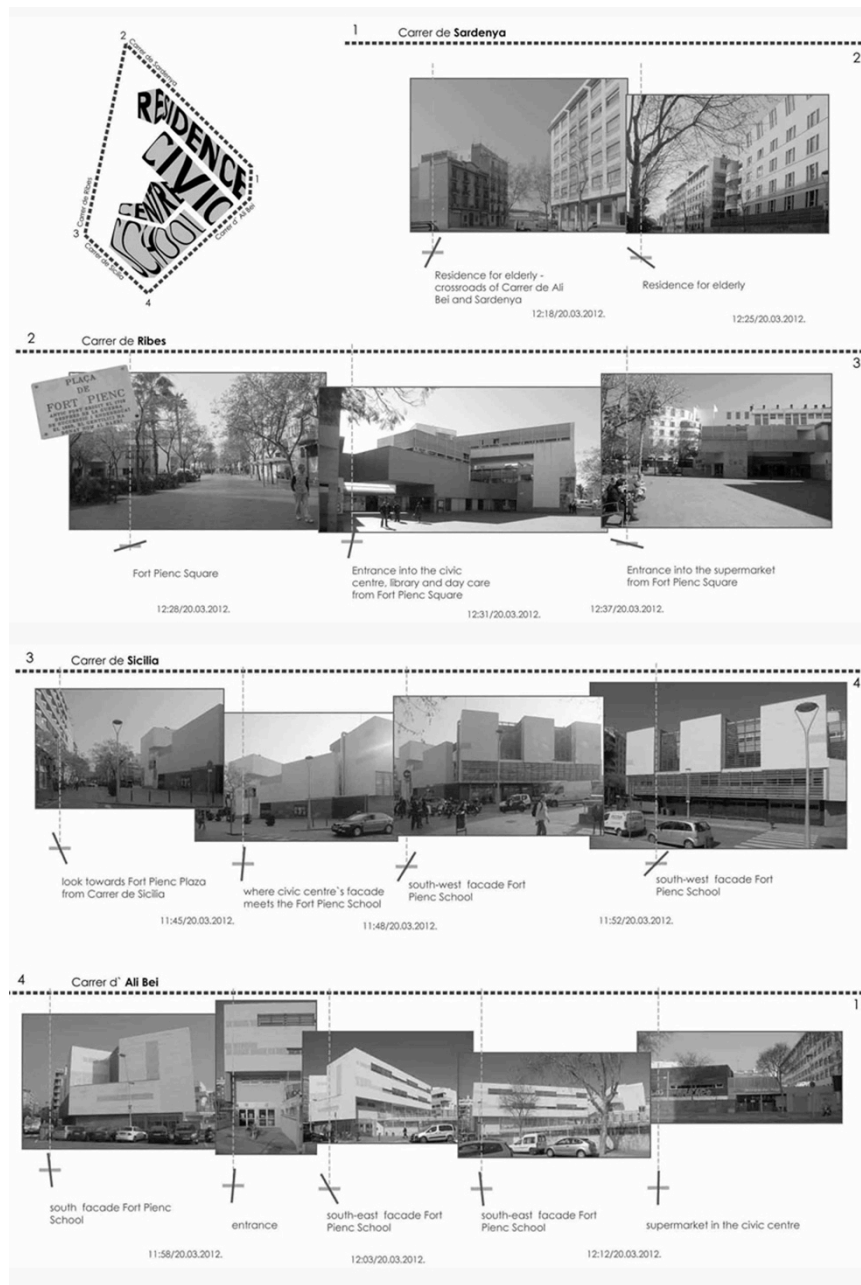


Figure 1. Fort Pienc school in Fort Pienc neighbourhood (Source: Brković, 2013)

Method and participants

The school's head teacher was first contacted and provided with information letters and consent forms. Later on, she explained the research project, and forwarded the letters and forms to the interested teachers and pupils. All participants were volunteers. Pupils aged 10-13 years

(7 boys and 8 girls) divided into four teams participated in a photo expedition followed by a semi-structured group interview, and a game (Fig. 2). The game Spector – Sustainability Inspector was played on two different days.

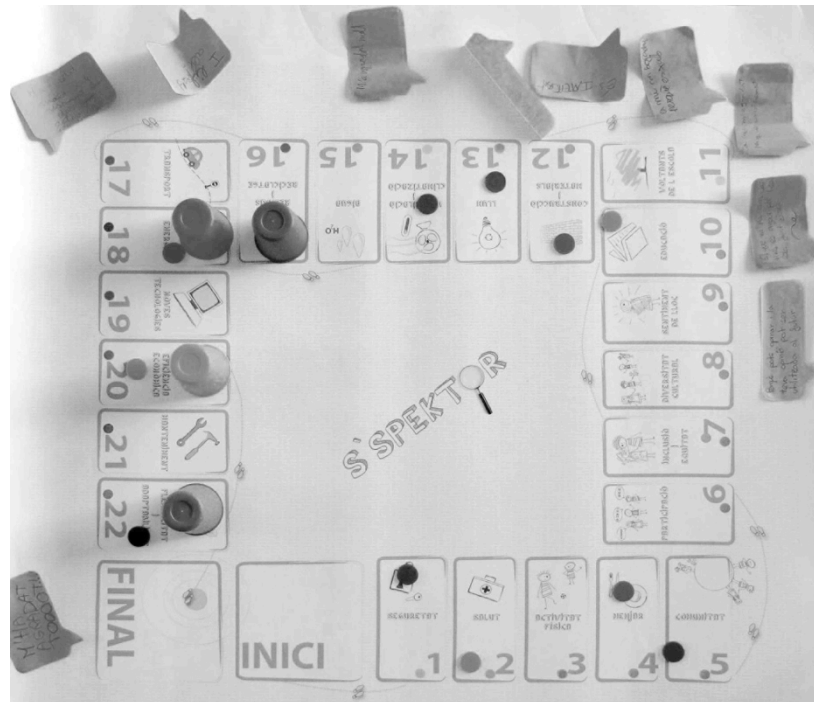


Figure 2. Game board (Source: Brković, 2013)



Figure 3. One of the game cards (Source: Brković, 2013)

The game consisted of four steps. The ‘Suspect’ step instructed pupils to pick from 22 cards with “suspected” sustainability topics extracted from the literature review. Each card was divided into two fields; “think about”, which explained the sustainability topic and asked pupils to give their

opinion, and “answer and photograph”, which instructed pupils to photograph school spaces related to the sustainability topic on the card, based on their own opinions (Fig. 3). The ‘Inspect’ step invited pupils to take a camera and photograph evidence for their answer (Fig.4). These photos were printed out and brought back to pupils for the second workshop. During day two, the ‘Discuss’ step signalled it was time for the board game (Fig.5). By rolling the dice, each team of pupils moved from one field to another. When one team landed on a particular field, everyone would reveal the photos they had taken on that topic and discuss them. The ‘Detect’ step encouraged pupils to locate the space shown in their photos on a provided school plan. Beside the photo, they placed post-its with their comments (red arrow - negative comment, green arrow - positive comment and speech bubble - new ideas and recommendations for improvement). After presenting and explaining their answers the next team was ready to roll the dice. The game was played until all the photos were revealed and all sustainability issues had been discussed and mapped.



Figure 4. (Left) Pupils during suspect and inspect step of the game (Source: Pupils, 2012).
Figure 5. (Right) Pupils during discuss and detect step of the game (Source: Brković, 2013)

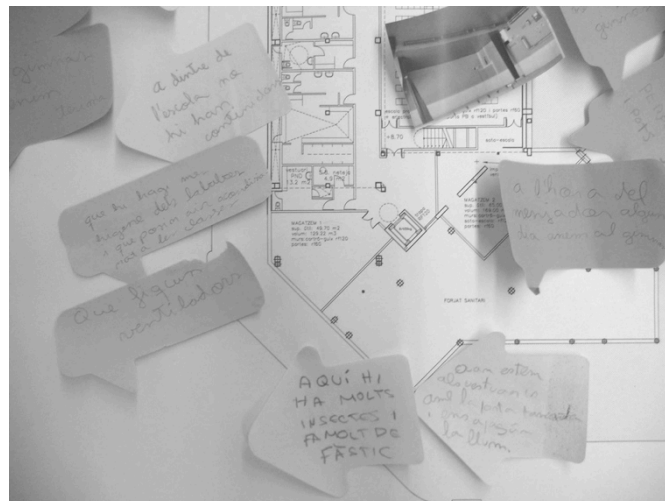


Figure 6. Detail of the map with teachers' comments (Source: Brković, 2013)

In total seven female teachers participated in a semi-structured group interview with mapping. One at a time, each teacher had to draw a card showing one of the 22 sustainability topics and start the discussion. The conclusions of the discussion were written again on the post-

its and pasted next to the relevant places on the school plans provided (Fig. 6). The discussion workshops with both pupils and teachers were audio and video recorded.

Data analysis process

Stage one of the data analysis started with *a priori* coding (Stemler, 2001). The codes for the first level of analysis were already built into the research tool – the 22 sustainability themes extracted from the literature. The teachers' and pupils' positive and negative comments, suggestions for improvement, and corresponding photos were first coded in this way, followed by the transcribed interviews, this time with the help of NVivo computer program. Then all the data gathered under each sustainability theme was separately coded, allowing emergent sub-categories to be identified. In this way several key themes or messages under each topic emerged, supported by pupils' and/or teachers' comments and photos.

The variety of data collection methods used to address the research questions, coupled with the two separate participant groups, permitted triangulation of the results. According to Marshal and Rossman (1995: 143), this multi-method and multiple informant approach also brings the advantage that it can "greatly strengthen the study's usefulness for other settings". Interpretation of the data was further supported by existing theory and literature from the fields of architecture, pedagogy, and developmental and environmental psychology. This process ultimately led to the development of a key set of messages that might usefully inform the design of sustainable schools as the third teacher.

FINDINGS

The findings presented below are grouped according to their relevance for each sustainability theme. Translated quotations from the interviews and photos are used to evidence the key messages developed under each sustainability theme, whether these messages are supported by teachers' comments, pupils' or both. Pseudonyms have been used for all participants.

Safety and Security

The teachers and pupils in FP revealed that the position of the school within the community and their mutual connections can impact upon a sense of community, out of which a feeling of safety and security springs. Both groups explained that a myriad of activities, within the school and the civic center, support teachers, pupils and community members to work together, and get to know each other better.

Previous empirically based research has shown that knowing your neighbours and being known by them (Reay and Lucey, 2000), and building strong connections between the school and the local community (Langhout, 2004), is what helps pupils perceive certain environments as safe. Creating a safe sustainable school is the task of the whole community, where the school should be functionally integrated within the community (Atlas and Schneider 2007). In safe environments children can establish new relationships (Human Science Research Council HSRC, n.d.) and create, develop and share important local knowledge.

According to teachers, the size of the space relates to the feeling of safety and security. Teachers explained that narrow corridors easily get crowded and cause stress, strain and even vandalism (Fig.7). An empirical study by Moore (1986) showed that high-density, crowded spaces cause psychological overexcitement; make children behave in a more aggressive, destructive, and less interactive way. In this way, the learning atmosphere can be severely disturbed.

The large majority of pupils stressed that the scariest places were in the basement where the gym is located. Luciano (pupil, 12 years), explains why:

"There's a room for the equipment by the gym which is full of bugs and it is gross. We do not feel safe there...it's scary when we are down there and the light is off" (Fig. 8).

This typical description pupils provided suggests that pupils associate the amount of light, the seclusion of a space and its cleanliness with their sense of fear or safety.



Figure 7. (Left) Narrow corridor in FP school. (Source: Pupils, 2012). Figure 8. (Right) Dark corridor leading to the gym in the basement (Source: Pupils, 2012)

Edwards and Torcellini (2002) have suggested that well-lit spaces reduce fear and increase the feeling of safety. When building design produces isolated, dark spots positioned far away from supervision (Atlas and Schneider, 2007), such as a gym in the basement of this school (Fig.8), it causes children to be fearful. The lack of cleanliness in the room for sports equipment, locker rooms and toilets made children feel unpleasant. Through incivilities and signs of disorder, what a school meta-communicates relates to pupils' perception of (un)safety (Langhout, 2004); transmits the message of responsibility and care, and impacts upon children's perception of a place as (un)welcoming (Maxwell, 2000). Tackling these problems through architectural design of a sustainable school is necessary because children should feel safe, secure and calm to be able to learn.

Physical activity

Despite a series of design flaws that the pupils spotted, such as no vegetation, no shade from the sun or from rain, and no places for children who do not enjoy football and basketball, the playgrounds, inside and outside the school, were most frequently described by pupils as places that stimulate them to be physically active, and even learn. Marco, (pupil, 13 years), explained:

"We have fun everywhere on the playground, we can play, talk, exercise... sometimes we learn with teachers there... we love our time on the playground."

As knowledge and action are interlinked, "the quickest way to activate the brain is to move" (Boys, 2011: 134). It has been argued that through physically challenging, but safe play and sport activities, children can not only stay healthy; but also learn about their bodies and the world

around them, relate to each other, establish relationships, learn to express feelings, release tensions, solve problems and use language (Malone, 2007; HSRC, n.d.). Accordingly, the playgrounds were delineated as good places for bonding, building group cohesion and developing social skills. Oriol, for example (pupil, 13 years) said: “We often play basketball and football with our teachers or with kitchen staff” (Fig. 9).



Figure 9. Playing sports with teachers (Source: Pupils, 2012)

Both teachers and pupils explained that they practiced sports together, and that non-teaching staff were sometimes included. These activities on various sport fields were described as enabling them to know each other better, feel closer, communicate easier and develop a stronger sense of community. Malone (2007: 8) argues that “play and recreational use of space...support communication, cooperation, appreciation, and responsibility”.

Food

All the pupils agreed that the raised beds are a valuable learning resource; they helped them socialise, demonstrate their skills and abilities. Simone (pupil 12 years) clarified why:

“We like the garden because we grow plants and learn about healthy eating, we play and have fun there...we are proud to have a garden...the vegetables we eat when they are grown make us healthy” (Fig. 10).

The children praised the raised beds not just because the food produced there made them feel healthy, but also because the activities around them helped them to learn and socialise. They all agreed that the activities around the raised garden beds were connected to the curriculum, and many parents and community members came to work with pupils there. On the other hand, what pupils reported as problematic was the fact that teachers saw the activities around cultivating plants and vegetables as fun and entertaining activities for the younger pupils, without also recognising them as serious learning opportunities.



Figure 10. Raised beds for planting in FP school (Source: Pupils, 2012)

The quality of food has an impact upon children`s health and consequently their ability to concentrate and learn in school (WHO, 2008). The activities around the raised beds present an opportunity for pupils to learn new skills, feel a sense of power, feel important to the community (HSRC, n.d.) and enable them to socialise and build group cohesion (WHO, 2008). The opportunity to take care of their environment offers a chance for children to exercise responsibility (Desmond et al 2004). Being in direct contact with nature, they are becoming sensitive to their environment and can develop skills for stewardship (Chawla, 2002). It could be concluded that food-growing facilities can be a valuable learning tool only when the learning activities around them are well-structured, connection to the curriculum is clear, and the roles and responsibilities of teachers, pupils and community members are well defined.

A sense of community

Interviews with teachers and pupils revealed that the position of the school within the community and the joint use of the facilities by school and the local neighbours are what foster the development of a sense of community. The “joint space use” strategy, alongside the limited space within the school, caused the teaching and learning to be taken outside the school walls. Trying to be as resourceful as possible, the school was using two nearby parks, Barcelona`s North Bus Station and all the facilities within the block (the square, the civic center, the children`s

center and the library) for curricular and extracurricular activities such as dance and theatre performances, recitals, concerts, fundraising for school trips, parties, parents' meetings, and school exhibitions. Community members also had a strong presence within the school. Teachers and pupils explained that a native Pennsylvanian female student, living in the neighbourhood, regularly gave English classes to the children. Parents and community members introduced their professions to pupils, planted, cultivated herbs, vegetables, and fruit in the garden, and decorated the school. Such a rich array of activity with and by wider community members underpinned the general positive comments about the school, such as this from Julia (pupil, 12 years):

"Here we are all good friends...we have good relationships".

Favourably positioned in the heart of the neighbourhood, this school is tightly interwoven into the community milieu. A multitude of activities in various school and civic center facilities are helping children to develop strong bonds, a sense of belonging, caring and responsibility. These close ties with the community can support both social and ethical development (Rigolon and Alloway, 2011).

The size of spaces and the opportunity for the levels of privacy to be regulated, strongly emerged as factors determining how successfully a certain space impacted upon the development of a sense of community. In FP, during the school breaks, many pupils could be found seated together in groups in different corners of the playground (under the stairs in the yard, behind the fences of the stairs, etc.) secretly whispering and playing games (Fig.11). Eva (pupil, 13 years) observed:

"We all really like the tables at the end of the playground, we like to sit on the benches...there we can play and talk with our friends in peace", and Alba (pupil, 12 years) added, "We like to sit in a corner and talk about our things".

Pupils preferred smaller, tucked in and out of the way places, where they can discuss things important to them. Yet, it was identified as a problem that the school lacks purposely designed small, calm and private niches that could stimulate encounters between the pupils and teachers.

Schools, like other (semi)public spaces, should allow levels of individual and group privacy to be regulated, as a uniform degree of intimacy decreases the possibilities for subtle interactions (Alexander, 1977). Beside the levels of privacy, the size of the space can have a crucial impact on social actions and interactions (Bell, 2006). Having a variety of smaller scale, lower height, tucked in spaces in schools enables encounters to happen naturally (Pasalar, 2004), and invite children to stop and communicate (Day, 2007). Empirical evidence shows that so-called "retreat and refuge shelters" can help children escape from intense everyday stimulation in school, offering an opportunity for pupils to form strong relationships and connections, discuss sensitive issues and learn to understand each other (Moore, 1986).



Figure 11. Lack of purposefully designed small, calm and private spaces in FP school (Source: Pupils, 2012)

Inclusion

Both teachers and pupils were quick to point out how school design is hindering or promoting inclusion. While toilets for disabled people, lifts and ramps were delineated as features that promote inclusion (because everyone, regardless of their abilities can use them; e.g. pupils in wheelchairs, as well as pupils with a temporary leg injury); small and narrow spaces were named as obstacles that made movement cumbersome for wheelchair users. For example Agatha (teacher, 42 years) complained:

“There is not enough room, classrooms are small and corridors are very narrow...it [moving around] is not easy.”

Teachers explained that having children in wheelchairs in the school who will constantly have to be accompanied by teachers or fellow pupils in order to be able to move around, is no different than pointing a finger at those children. This implies that inclusion depends on compatibility between the functional capacities of a person or a group and their environment (Iwarsson and Stahl, 2003). Additionally, it has been argued that spatial relations can represent and reproduce social relations (Malone, 2007). In this way physical barriers can be transformed into social, emotional and mental ones. Hence, inclusive design has to take into account not just physical access, but emotional and intellectual issues as well (CABE, 2006).

Pupils' comments and discussion revealed that feelings of inclusion or exclusion can be developed through (physical) activities in school yard, thus further weaken or strengthen a sense of community. All pupils stressed that during playtime, some of their friends were left out because football and basketball courts take up the whole outer yard. Some of them did not enjoy playing these sports, and some of them were not able to due to their disabilities. Diego (pupil, 13 years) commented: "There should be a place for people who do not play football or basketball... something, some activities for them to do" (Fig. 12).



Figure 12. Pupils who do not play football and basketball are left aside (Source: Pupils, 2012)

Tackling this problem through design and providing enough space with various engaging (physical) activities for everyone is crucial, because on sport fields and playgrounds children receive affirmation, gain visibility and respect from their peers (Atensio, 2007: 115). Engaging in physical activities, pupils take up certain roles, make judgments about themselves and others, and in this way construct their identities. According to CABA (2006), participation in physical activities impacts upon interpersonal relationships among children, as well as development of social hierarchy. These hierarchies in turn impact upon inclusion or exclusion.

A sense of place

The design of the facades and entrances emerged as an important element communicating a sense of place. According to teachers, the physical characteristics should correspond to the schools' ethos. Yet the way FP feels and looks outside and inside is not representative of the schools' pedagogical ideas, its strength in the art, music and environmental curriculum, or its core values and beliefs. The entrances are very small and unable to demonstrate the welcoming spirit of the school. By strictly following the language of the block, today the school building has

completely blended in, and there are no visual clues that behind these facades there is a school (see Fig. 1 above). It is been argued that by contrast, a carefully designed, authentic aesthetic for a school façade can attract attention and also transmit the values and the pedagogical ideas of the school, providing in-part the identity of a school and signalling how a community values education (Walden, 2009). Also the design of entrances is important as it can determine the type of messages and the pace of interactions cherished at schools (Ogden et al, 2010).

School design should be a skilful interpretation of the ideas, wishes and beliefs of school members, in order to contribute to a sense of place. Teachers explained that due to the tight budget, out-dated and strict government educational standards, the school today does not communicate their primary idea that learning happens everywhere and that all learning styles are supported. Additionally, pupils' opinions on the overall look and form of the school were divided:

“There are other schools that are better, bigger and nicer” - Marco, 12 years;

“It has a strange shape” - Paolo, 13 years;

“The shape of the building is ok and the colours are very nice” - Celia, 14 years;

“I think the shape is a unique shape” - Gracia, 12 years.

Pupils could not name any distinguishing characteristic of their school space, explain how it was unique or special, explain how the school space made them feel, whether or not they were attached to it and whether it was personally significant to them. It is crucial that a school space is representative of a school's values and users' identities, because, as Proshansky, Fabian, and Kaminoff (1983) argue, place identity impacts upon a person's self-identity and vice-versa.

Light, ventilation, and cooling/heating

Evidence from the interview with teachers and pupils suggests that light and ventilation, cooling and heating issues should be carefully designed from the start. It emerged that design oversights in this realm can have a negative impact on learning and working, and translate into extra spending. For example, Agatha (teacher, 37) commented: “Because we cannot move the blinds outside we had to buy curtains and movable blinds for the inside.”



Figure 13. Façade with unmovable blinds with a bus station in front (Source: Pupils, 2012)

The large majority of pupils and teachers complained that some windows could not be used due to the busy bus station below, exhaust fumes and very high noise levels (Fig.13). Immovable blinds over large glass surfaces were ineffective, making the spaces too bright and too hot, especially during warm months. These oversights translated into extra spending to try to overcome the problems. Such issues should clearly be taken into consideration from the outset, because poor environmental conditions have been shown to negatively influence children's cognitive development and cause underperformance on academic tests (Cohen et al, 1980).

Materials, construction, and energy

The pupils had easily picked up information about environmental sustainability issues from their school environment, despite not using the full potential of a school building as a teaching tool. Pupils were able to recognise sun blinds and sun protection panels as features that help the building remain cool, and reduce the electric energy needed for cooling; "push on taps" as part of the water saving strategy; and solar panels for water heating. Additionally, they reported a variety of behaviours that wasted energy and water and suggested many improvements in order to make their school more sustainable.

Flexibility and adaptability

When the flexibility and adaptability of school spaces is not a product of strategic design, but rather a necessary result of the lack of space, the quality of learning in those spaces could be compromised. A typical complaint of pupils was like the one from Martin (pupil, 10):

"the science classroom should be the science classroom and should be used as the science classroom!"

Both the teachers and pupils strongly agreed that the lack of space within the school forces teachers to constantly change venues for some classes and to hold them in inappropriate spaces for the subject, for example, the kindergarten bedroom is used for music lessons and the science classroom for dance lessons. (Fig.14). This very often causes confusion among the children.



Figure 14. Kindergarten room for sleeping is also used for music lessons (Source: Pupils, 2012)

If we want to use sustainable school buildings as tools supporting exploration and learning, such conflicts should be avoided. Instead, resource-rich, flexible and easily arrangeable spaces in schools should be carefully designed as they can support social and emotional learning, practical experience, reflection and action, work in large groups or individual and quiet study - different intelligences, needs and learning styles (Nair and Fielding, 2005). Such spaces give pupils an opportunity to manipulate space, build responsibility, pride, and have an active role in

their learning process. In such settings, children are more active and engage themselves in more diverse activities (Cohen et al, 1987).

CONCLUSIONS AND RECOMMENDATIONS

In this qualitative study, giving a rich picture with greater depth of understanding has been a priority, instead of generalisation. The discovery of meaning that different participants ascribed, as a way of identifying important issues, was crucial. So that the key messages are made valuable for other settings, they were triangulated with a wide variety of literature available. However, further studies exploring sustainable schools designed to act as the “third teacher” are needed to strengthen our understanding of this field. Despite these limitations, the findings of this study could help us in future to design pedagogically more valuable sustainable schools.

The way school design addresses some of the sustainability issues here identified through literature review, can directly or indirectly act pedagogically. The raised beds in the school present an architectural response to growing demand for places where children might learn experientially about healthy nutrition and plants growing. Engaging with these features, through various activities, pupils can learn from those engagements. On the other hand, the way school design responds to a variety of safety and security issues, or a sense of community, indirectly contributes to the quality of the learning atmosphere within the school.

The layout, the design features, technical and technological installations should emerge from the contextual challenges, and should be in accordance with teaching and learning activities, methods, and approaches, so as to be pedagogically valuable. During the design phase in FP teachers suggested incorporating some technical systems that could be used as a three-dimensional teaching tool; however, due to the out-dated school building standards, architects could not translate this into design. Today, school building fabric does not correspond completely to teachers’ pedagogic vision and is not used enough for learning.

School spaces able to act as “the third teacher” were the ones where place, participants in the learning process, and learning activities were well connected and mutually interconnected. Pupils and teachers valued these places for what they could become through use. To illustrate, a very important factor impacting upon the pupil’s perception of safety in FP was the way teachers, neighbours, and parents work, take care, and protect the pupils. In this case, pupils associated space with the people and their close-knit relationships. Additionally, both the teachers and pupils in FP valued the garden and the places around the school (e.g. the plaza, the park) because they knew how to use these spaces and adapt them for various activities. The participants in this study associated space with activities occurring in them. Therefore, school space should not be seen just as physical entity, but as social and activity-based as well. The physical design of a school space is not the only factor determining how successfully a certain space can facilitate learning. The design of the physical fabric should be in tune with the curriculum, the type of activities, and the engagement of teachers and pupils, to act pedagogically.

Lastly, architects’ designs and visions do not translate directly into learning experiences of occupants. Even when architects integrate design features and installations, which have pedagogical potential, such as solar water heaters in FP, they should not assume that this is enough to incite learning. Choreographed space uses, taking into account the space, the participants in the learning process, and the activities, should be developed to support pupils and teachers to skilfully and knowledgeably transform their school space according to their needs, wishes and teaching and learning methods. The transformation process during the inhabitation could become a learning process through which occupants explore, get to know and positively appropriate their environment.

Focusing the discussion on Spain, many recently built schools have been constructed following tight time frames and low budgets. Though the economic situation carries strong limits,

schools should be pedagogically significant, leaving the opportunity for users to adapt, modify and personalise the environment. Collaborative efforts are needed to work towards this goal. Architects need to develop critical thinking in this area and be allowed to contribute to the debate at a policy level as well as at the local design level. In schools of architecture there is potential for the curriculum to more deeply and fully embrace sustainability and to support dialogue between sustainability and pedagogically significant theories. School building standards require modernisation to support both sustainability and pedagogy. Participatory school design and strong collaboration needs to be developed between educational departments, pedagogues, psychologists, architects and school communities to both build new schools and reconstruct old ones. Without such changes, there will be no significant improvement, the pedagogical potential of school buildings will remain underdeveloped and sustainable schools will remain isolated sporadic cases of good practice, as they are now, being an exception rather than the rule.

ACKNOWLEDGEMENTS

We are grateful to Santander Research Mobility Award and Funds for Women Graduates for financial support; Josep Manel Oliva, Reyes Brun and Pich Aguilera Architects for their support and advice; to Sandra Ruth Maas and Prue Chiles for their constructive criticism.

REFERENCES

- Atlas, R. & Schneider, R.H. (2007). Schools Behind Bars? Designing safe and secure environments for schools and colleges doesn't mean they need to look like detention facilities. *School Security, Security Technology and Design* (pp.32-38). <http://www.experts.com/content/articles/ratlas5-schools-behind-bars-design-safety.pdf>, Access Date 07/05/2015.
- Alexander, C. (1977). *A pattern language towns, buildings, construction*. New York: Oxford University Press.
- ASHARE Organization (2011). *Advanced energy design guide for K-12 schools Achieving 50% Energy Savings:Toward a Net Zero Energy Building*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- Atensio, M. (2007). Basketball is like breathing: Young people`s use of urban physical activity spaces. In Malone, K. (2007). *Child Space: An anthropological exploration of young people's use of space* (pp.94-126). New Delhi: Concept Publishing Company.
- AWP/P Architects, VS Furniture and Bruce Mau Design (2010) *The Third Teacher: 79 Ways You Can Use Design to Transform Teaching & Learning*. New York: Harry N Abrams Inc.
- Bell, S. (2002). Spatial cognition and scale: a child's perspective. *Journal of Environmental Psychology* 22, 9-27.
- Bestraten, S. & Hormias, E. (2009). Madera y prefabricación escolar (Wood and school buildings prefabrication) (*AITIM*).
- Biomass (2011). Los colegios apuestan cada vez más por las calderas de biomasa, <http://www.biomasaforestal.com/2011/03/los-colegios-apuestan-cada-vez-mas-por.html>, Access Date 25/11/2014.
- Brković, M. (2013). Sustainable schools as the 'third teacher': Creating a design framework for sustainable schools in Serbia, learning from practices in England, Germany, and Spain, University of Sheffield (PhD thesis). <http://etheses.whiterose.ac.uk/4513/>, Access Date 07/05/2015.
- CABE (2006). *The principles of inclusive design: they include you*. London: Commission for Architecture and the Built Environment.
- Chawla, L. (2002). Insight, creativity and thoughts on the environment: integrating children and youth into human settlement development. *Environment & Urbanization* 14 (2), 11-22.

- Collaborative for High-Performance Schools, (CHPS) (2006). *Best Practice Manual, Design, Volume II*. The Collaborative for High-Performance Schools.
- Cohen, S., Evans, G.W., Krantz, D.S. & Stokols, D. (1980). Physiological, motivational, and cognitive effects of aircraft noise on children: Moving from the laboratory to the field. *American Psychologist* 35, 231-243.
- Cohen, U., Moore, G.T. & McGinty, T. (1978). *Case studies of child play areas and child support facilities*. Milwaukee: University of Wisconsin-Milwaukee, Center for Architecture and Urban Planning Research.
- Day, C. (2007). *Environment and children: Passive lessons from everyday environment*. Oxford: Architectural Press.
- Department for Children, Schools and Families (DCSF) (2008). *Planning a sustainable school. Driving school improvement through sustainable development*. Nottingham: DCSF.
- Department for Education and Skills (DfES) (2006). *Design of Sustainable Schools: Case Studies*, Schools for the Future series. Annesley: DfES.
- Desmond, D., Grieshop, J. & Subramaniam, A. (2004). *Revisiting garden-based learning in education*. Rome: Food and Agriculture Organization of the United Nations.
- European Commission Energy (ECE) (2012). Energy Management Agency of Malaga. <http://www.managenergy.net/actors/2380>, Access Date 07/05/2015.
- Educational Department (ED) (2012). *Escoles Verdes (Green schools)*. <http://www20.gencat.cat/portal/site/mediambient/menuitem.64be942b6641a1214e9cac3bb0c0e1a0/?vgnnextoid=7cc460adde597210VgnVCM1000008d0c1e0aRCRD&vgnnextchannel=7cc460adde597210VgnVCM1000008d0c1e0aRCRD&vgnnextfmt=default>, Access Date 25/11/2014.
- Educational Department (ED) (2001). *Criteria per a la construcció de nous edificis per a centres docents públics*. Barcelona: Generalitat de Catalunya.
- Edwards, L. & Torcellini, P. (2002) *A Literature Review of the Effects of Natural Light on Building Occupants*. Technical report. NREL/TP-550-30769, <http://www.nrel.gov/docs/fy02osti/30769.pdf>, Access Date 07/05/2015.
- Etwinning (2009-2010). *Creating sustainable schools*. Project, <http://www.etwinning.net/en/pub/profile.cfm?fuseaction=app.project&pid=13856&lang=en#aims>, Access Date 07/05/2015.
- Gaia Architects (2005). *Design and Construction of Sustainable Schools*. Vol. 01 Lessons from School Buildings in Norway and Germany. The Lighthouse.
- Gelfand, L. & Freed, C. E. (2010). *Sustainable School Architecture: Design for Elementary and Secondary Schools*. New Jersey: John Wiley and Sons.
- Generalitat de Catalunya (GC) (Catalan Government) (2009). Articles 5 and 6 "Paràmetres ambientals en edificis i paràmetres d'ecoeficiència relatius als materials i sistemes constructius" in *Decret d'Ecoeficiència de la 21/2006. (Efficient Ecologic Decreed 21/2006)*
- Gough, A. (2005). Sustainable Schools: Renovating Educational Processes. *Applied Environmental Education and Communication* 4, 339–351.
- Hammersley, M. (1992). *What's wrong with ethnography?: Methodological explorations*. London: Routledge.
- Human Science Research Council (HSRC) Chapter 3 Methods to help children feel calm and safe. In *Emotional Behavior book*. <http://www.hsrc.ac.za/Document-1674.phtml>, Access Date 25/11/2014.
- Iwarsson, S. & Stahl, A. (2003). Accessibility, usability and universal design positioning and definition of concepts describing person-environment relationships. *Disability & Rehabilitation* 25 (2), 57-66.
- Khan, S. and Kotharkar, R. (2012). Through the eyes of the learner: A critical evaluation of an urban Indian school. *International Journal of Architectural Research*, 6 (2), 79-97.

- Langhout, R.D. (2004). Facilitators and inhibitors of positive school feelings: An exploratory study. *American Journal of Community Psychology* 34, 111–127.
- Lewis, M. (2010). Sustainability: The view from a practitioner's perspective. *International Journal of Engineering* 26 (2), 247-251.
- Lippman, P.C. (2010). Evidence based design of Elementary and Secondary schools. Hoboken: John Wiley and Sons.
- LPA (2009). *Green School Primer: Lessons in Sustainability*. Mulgrave: The Image Publishing Group.
- Macías, M. & García, J. (2010). Metodología y herramienta VERDE para la evaluación de la sostenibilidad en edificios. *Informes de la Construcción* 517, 87-100.
- Malone, K. (2007). *Child Space: An anthropological exploration of young people's use of space*. New Delhi: Concept Publishing.
- Marschall, C. & Rossman, G.B. (1995). *Designing qualitative research*. 2nd ed. London: SAGE.
- Maxwell, L.E. (2000). A safe and welcoming school: What students, teachers, and parents think. *Journal of Architectural and Planning Research* 17: 271–282.
- Ministry of Education (ME) (2010). Real decret 132/2010.
- Moore, G.T. (1986). Effects of the spatial definition of behaviour settings on children's behavior. *Journal of Environmental Psychology* 6 (3), 205-231.
- Nair, P. & Fielding, R. (2005). *The Language of School Design: Design Patterns for 21st Century Schools*. Designshare, Inc.
- Newton, C., Wilks, S. and Hes, D. (2009). Educational buildings as 3D text books: Linking ecological sustainability, pedagogy and space. *Open House International*, 34 (1), 17-25.
- Ogden, H., Uptis, R., Brook, J., Peterson, A., Davis, J. & Troop, M. (2010). Entering School: How Entryways and Foyers Foster Social Interaction. *Children, Youth and Environments* 20 (2), 150-174.
- Orr, D. (2004). *Earth in Mind: On education, environment and the human prospect*. 10th ed., Washington: Island Press.
- Pasalar, C. (2004). The effects of spatial layouts on students' interaction in middle schools multiple case analysis. <http://www.lib.ncsu.edu/resolver/1840.16/5083>, Access Date 07/05/2015.
- Proshansky, H., Fabian, A.K. & Kaminoff, R. (1983). Place-identity. Physical world socialization of the self. *Journal of Environmental psychology* 3, 57-83.
- Pons, O. & Aguado, A. (2012). Integrated value model for sustainable assessment applied to technologies used to build schools in Catalonia, Spain. *Building and Environment* 53, 49-58.
- Pons, O. & Wadel, G. (2011). Environmental impacts of prefabricated school buildings in Catalonia. *Habitat International* 35, 553-563.
- Reay, D. & Lucey, H. (2000). 'I don't really like it here but I don't want to be anywhere else': children and inner city council estates. *Antipode* 32 (4), 410-428.
- Rigolon, A. & Alloway, M. (2011). Children and their development as the starting point: a new way to think about the design of elementary schools. *Educational and Child Psychology* 28 (1), 64-76.
- Salama, A. M. (2009). The users in mind: Utilizing Henry Sanoff's methods in investigating the learning environment. *Open House International*, 34 (1), 35-44.
- Sanoff, H. (2008). Multiple views of participatory design. *International Journal of Architectural Research*, 2 (1), 57-69.
- Silverman, D. (2008). *Doing Qualitative Research: A comprehensive guide*. London/New Delhi: SAGE Publications.
- Spanish building standards (Código Técnico de la Edificación (CTE)) (2006). Madrid: Ministerio de la Vivienda.

- Targetzero (2010). Guidance on the design and construction of sustainable, low carbon school buildings. Report V1.0, February 2010. Online: www.targetzero.info/news/release/new_sustainable_schools_guidance_published, Access Date 07/05/2015.
- Taylor, A. (2009). Linking architecture and education: sustainable design for learning environments. New Mexico: The University of New Mexico Press.
- UNESCO Institute for Statistics (UIS) (2012). *A place to learn: Lessons from research on learning environments*. Montreal: UNESCO Institute for Statistics.
- Wade, R. & Parker, J. (2008). EFA-ESD Dialogue: Educating for a sustainable world. In *Education for Sustainable Development Policy Dialogue No. 1, UNESCO*. <http://unesdoc.unesco.org/images/0017/001780/178044e.pdf>, Access Date 25/11/2014.
- Walden, R. (ed) (2009). Schools for the Future: Design proposals from Architectural Psychology. Goettingen: Hogrefe.
- Webecoist (2011). Sustainable Schools: 14 Smart Green Learning Facilities. In *Going beyond green*. <http://webecoist.momtastic.com/2011/06/17/sustainable-schools-14-smart-green-learning-facilities/>, Access Date 07/05/2015.
- World Food Programme (WHO) (2008). School feeding policy – a hunger safety net that supports learning, health and community development. Rome: WHO.
- Yin, K.R. (2008). *Case Study research: Design and Methods*. 3rd edition. London: SAGE.

AUTHORS

Dr. Marta Brković

Founding Director

ARQubator, Belgrade, Serbia

marta.brkovic@gmail.com

Dr. Oriol Pons

Postdoctoral Researcher

Barcelona School of Architecture, Barcelona Tech (UPC), Barcelona, Spain

oriol.pons@upc.edu

Dr. Rosie Parnell

Senior Lecturer

Sheffield School of Architecture, Sheffield, UK

r.parnell@sheffield.ac.uk