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Primary School Design: Co-Creation with Children

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1. Introduction

Children are frequently disregarded in the society that most of the time adults make the majority of decisions for them. Co-designing with children challenges this point of view, opting to see children as social actors who are beings and not becomings (Clark, 2005). Research studies highlighted that children gravitate naturally to a purposeful engagement with their material world, and that they have strong feelings and lots of implicit knowledge about the environments they use every day (Hart, 1997; Chawla, 2001). Research into participatory practices, where school children and professionals work together on design and build projects (Sorrell, 2005; Ghaziani, 2012; Haffman, 2014) indicates that children are natural designers and experts in their own environments. Therefore, as experts of their own experiences, it is important to include children in decisions regarding their everyday life, particularly design of their schools. This paper explores different data collection methods with children and presents the findings that emerged from children's perspective about the design of the educational spaces that they would like to have in their schools.

2. Involving Children in Design

An excessive deal of school architecture in England has been commissioned by clients who are not necessarily school users and direct communication between designers and users has regularly been limited to few school representatives (Parnell *et al.*, 2008). Creating Excellent Primary Schools (CABE, 2010) highlights the importance of good design and includes a number of case studies and practical examples in the UK; however, children's involvement, specifically was not the focus of the case studies as the report does not present the details of methods and findings; however, it suggested to involve children and other school users in design process. There is a growing body of research and examples of involvement of children with architects (e.g. www.designingwithchildren.net, www.baupiloten.com) as well as UK's Government-led Building Schools for the Future Programme (BSF) of 2005–2010, which helped to mainstream school-based co-design projects between practitioners and stakeholders (Burke, 2007), including Joined up Design for Schools (Sorrell, 2005) and Young Design Programme (The Sorrell Foundation, 2006). As co-designers, the idea is to view children as equal stakeholders throughout the entire experience, contributing to the process as experts of their own lives. It is important to acknowledge their competence and provide them with methods of self-expression that encourages comfort and creativity.

User participation should be as part of the foundation for a design proposal, which leads to a design that is highly relevant in terms of use and increased sense of belonging (Hofmann, 2014). Co-designing with users indicates collective creativity applied across the span of a design process (Sanders and Stappers, 2008). In the recent years, designers have become increasingly aware of the value and expertise children bring to the design process by being included in many different ways. Druin (2002) describes four different roles a child can possess, namely that of a user, a tester, an informant or a design partner - these roles differ from merely observing to actively working with a child. As a user and a tester, the child is given a passive role to utilise and test

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3 new solutions while adults observe and learn from his or her experiences.
4 However, as an informant, the child is expected to give input in various stages
5 of the process, as a design partner he or she is considered an equal
6 stakeholder throughout the entire experience.
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9 Building further on Druin's model, a role was introduced that empowers the child
10 more in a design process - seeing the child as the protagonist (Iversen et al.,
11 2017). Treating the children as protagonists encourages reflection and for the
12 them to be the main agents driving the entire process. The focus is not only on
13 working together towards a product output, but to enhance the insight, design
14 skills and the reflective thinking capabilities of the participants. Doorn (2016)
15 expanded the role of the child in a design process even further, by introducing
16 the role of co-researcher that enables the child to gather rich data because they
17 share the same context as the participants in a design process.
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21 When conducting a co-design project, good communication is vital and it needs
22 a secure environment in which the children and the researcher/architect feel
23 comfortable in order to be creative and discuss various ideas. In addition, as
24 Hofmann (2014) recommends a trustful interaction between users (children)
25 and architects that each respects the other's particular knowledge, expertise
26 and respective roles is needed. Therefore, it is important to even the power gap
27 between the researcher and the children and learn something valuable that
28 children bring to the process. Finally, in order to extract children's views, co-
29 design methods need to be adapted to the child's expressive needs. **This study**
30 **evaluates the different ways in which children could get involved in designing**
31 **primary schools (indoor and outdoor spaces) to identify spatial design trends**
32 **from the perspective of the children.**
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35 **3. Research Methods**

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37 In order to obtain permission for this research, there were two stages to pass: 1)
38 gaining authorisation from Faculty of Art, Design and Architecture at De-
39 Montfort University, 2) obtaining permission from those under the schools'
40 authority: headteachers, children and parents. Children between the ages of 8
41 and 10 in two Primary Schools in West Midlands, England, were participated.
42 They were informed about different aspects of the co-creation project, and their
43 own rights and privacy concerns. They were also informed that their opinions
44 are of value for the school and the researcher.
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48 **The two schools with distinct architectural styles have been located in very**
49 **different areas of the city. Earlsdon Primary School has been situated at the**
50 **southwest of the city and is housed in a Victorian building which opened for in**
51 **1890. This is a school that is of high quality for high socioeconomic status**
52 **students. In comparison, Broad Heath Primary School has been located in the**
53 **north of the city in low quality socioeconomic status community. However, the**
54 **school is a renovated modern building with state-of-the-art facilities and it had a**
55 **massive extension in 2013 and was doubled in size.**
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58 Various data collection methods were used, including questionnaires, drawings
59 and model making to gather children's views. Drawing allowed children to
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3 express their views about their environment (Sanoff *et al.*, 2001) and as a visual
4 strategy helped children to clarify a point under discussion (Cox and Robinson-
5 Pant, 2003); however, as drawings may be subject to false interpretations, it is
6 essential to correlate these with a selection of other sources of information and
7 to operate in an open exploratory way with children and their drawings (Greig
8 and Taylor, 1999). Therefore, to increase the validity of data, this study used a
9 combination of data collection techniques to identify the meaning behind
10 children's drawings and improve the quality of data analysis.
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13 Following the Mosaic Approach, which includes three main stages (Clark and
14 Moss, 2011), this study included another initial stage to inspire children with
15 diverse design possibilities in order to encourage creative thinking as follows:
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- 18 • Stage zero: presentation of various design examples to the children
- 19 • Stage one: gathering child's view by using individual questionnaire
- 20 • Stage two: piecing together the gathered views of children, allowing
21 discussion of questionnaires in pairs and using drawing technique
- 22 • Stage three: presentation of suggested changes, using model making
23 technique in groups.
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28 4. Studies and results

29 4.1 School garden design

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31 Majority of Primary School grounds are made of concrete and grass; however,
32 they can be transformed into varied, ecologically-rich places of learning for
33 children. This transformation can benefit from the co-design with children and
34 the input of architects, landscape architects and educators. School ground
35 greening is a term widely used for establishing gardens and varied plantings
36 within schools (Dyment and Bell, 2007), and the rationales and benefits are
37 countless and confirmed (e.g. Williams and Brown, 2012). Outdoor learning is
38 believed to provide more memorable and stimulating learning experiences
39 (Dillon *et al.*, 2006; Nundy, 2001). The need for the outdoor learning has been
40 emphasised by learning outside the classroom manifesto (DfES, 2006) as
41 school gardens offer significant benefit in terms of learning through experience
42 (McCarty *et al.*, 2018) and increasing fruit and vegetable knowledge among
43 children (Parmer *et al.*, 2009).
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48 Biophilic design patterns (Ryan *et al.*, 2014) can be used in school grounds for
49 greater connectivity between outdoor spaces and nature. A recent research on
50 child-nature-distance studies that measures children's experiences of nature
51 within three primary school spaces in Scotland, highlights well-designed
52 educational environments are crucial to supporting the proximity to nature,
53 particularly in the early years of schooling (To and Grierson, 2019). In addition,
54 there has been growing movement of outdoor learning in recent government
55 investments, including Nature Friendly Schools (The Wildlife Trusts, 2019) to
56 support schools in increasing children's opportunities to learn outside the
57 classroom. However, a recent study of school grounds and their use to support
58 biodiversity conservation and children's environmental education revealed that
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3 British schools are under-using their grounds to provide habitats and
4 environmental education (Harvey *et al.*, 2020). Therefore, planning and
5 designing child-centred outdoor spaces in schools is crucial nowadays.
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8 Earlsdon Primary School decided to extend its school ground greening by
9 buying the triangle shaped land behind the school playground and convert it to
10 a garden for children. Therefore, it was a great opportunity for children to be
11 involved in design process. In June 2019, 30 Year 4 children in Earlsdon
12 Primary School participated to design a garden for their school behind the
13 existing playground area. Their teacher, teaching assistant and the researcher
14 were assisting children at different stages of this co-creation project - design of
15 a peace garden influenced by Japanese gardens - during the school day.
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18 The project started with presentation of few slides related to basic rules in the
19 design of Japanese gardens, examples of garden design (images and
20 drawings) and basic information about the site and scale. After the presentation
21 in Year 4 classroom and explaining different stages for the project, children
22 completed their individual questionnaires. Next stage was drawing in pairs.
23 Children were given a site drawing of 1/50 scale on A3 size paper to draw their
24 suggested design related to their questionnaires as discussed in pairs (see
25 Figure 1).
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[Figure 1]

49 Final Stage was model making (in groups of three children). Each group was
50 given a site drawing of 1/50 scale on a cardboard to start their model making.
51 Moreover, they were given few model making figures (of people) to help
52 understand the scale of their models. Children could use the school hall beside
53 their classroom as more space was needed for this part of project. They could
54 access different materials that were provided for them by the researcher and
55 the school. The researcher, teacher and teaching assistant were assisting
56 children to access the materials that they needed for their models. Figure 2
57 presents the process of model-making by children and their final models.
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[Figure 2]

The most preferred space in the garden was relaxing area by water (waterfall, pond, foundation) as part of the design. Besides, reading corner and sports area were equally chosen as the second preferred spaces. In addition, the main materials suggested to be used in the garden were 'wood' and 'stone'; however, 'bamboo' and 'sand' were chosen by some children.

Regarding the features, most children suggested they would like to have 'flower garden' (83%) with the paths (93%) and 'benches/seating' (93%). 'Grasse' was suggested by 73%, while 'evergreen plants' were chosen by 63% and 'four season interest' by 50%. Interestingly, sculpture was identified as preferable feature by 73% and 'water features' (including ponds, waterfall and water fountain) were suggested by 60% of children. Finally, a bridge over the pond was preferred by 53% and stepping stones were suggested by 50% of children.

Majority of children suggested their designed garden responds to different senses by including the following features in order as follows.

- Sound: 1) running water (the most preferred feature) 2) birds 3) waterfall
- Touch: 1) stones 2) flowers 3) trees 4) rocks 5) bamboo
- Sight: 1) animals (e.g. birds, Kio fish, squirrel) 2) water and waterfall 3) flowers, plants 4) bridge 5) trees
- Smell: 1) flowers (e.g. Lavender) 2) nature (e.g. moss, herbs, plants)

Overall, regarding their feelings, children expressed this suggested garden makes them happier (93%) and it can help them feel relax (93%). Finally, children completed a short evaluation form and highlighted that all enjoyed the design and model making experience.

4.2 Re-design of indoor spaces

This study was conducted at Broad Heath Primary School in June 2019 to involve children in re-design of two spaces - the Studio (Figure 3a) and School Hall (Figure 3b). The project started with presentation of various examples of school halls, dining halls and multi-function spaces in different schools. The

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3 Power Point presentation for 90 children in Year 5 (in three classrooms) was
4 carried out in the Studio - one of the spaces that children planned to re-design.
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27 The children came back to their classroom and started completing their
28 individual questionnaires; however, children in two classrooms focused on re-
29 design of the Studio and children in the third classroom carried out with re-
30 design of their school hall. All children started to draw their ideas as sketches
31 before starting model-making in groups of three or four. Children could use the
32 corridor beside their classroom to access different materials that were provided
33 for them by the researcher. The children who completed their models were
34 asked to write a summary of their idea on a piece of paper. Although not all
35 children could re-design both spaces in the allocated time, a number of them
36 were able to.
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41 **4.2.1 Re-design of Studio** 42

43 54 children in Year 5 participated to re-design the studio - a multi-functional
44 space that can be used for drama, PE, assemblies and lunchtime clubs.
45 Children were asked what they do not like about their studio and they stated the
46 studio is too hot, looks dull and the floor is hard. Regarding the change, children
47 suggested that they would like to change the walls (by adding colours and
48 patterns, removing the characters, adding plants, windows and hexagonal
49 shape seats nested in the wall), the ceiling (including fans and air conditioning,
50 adding colours and making the sky show), the floor (by adding carpet and
51 beanbags, having extra floor accessible by a staircase). Figure 4 presents few
52 suggested ideas. Moreover, regarding the colours, children suggested they
53 would like varied bright colours – 'blue' was chosen by over 50%, while 'red and
54 green' were equally selected by almost 30% of the children. For artwork,
55 children suggested abstract, 3D artwork as well as patterns of nature (including
56 trees and waterfall).
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3 In addition, children shared their views related to various surfaces. For re-
4 design of walls, children advised painting them to 'change their colours'. They
5 also suggested inclusion of the walls that can store 'seats' in them as well as
6 living planted walls. Children highlighted that they would like to add colours to
7 the floor and change the material in order to be soft and comfortable (e.g.
8 carpet). Regarding the ceiling, they suggested adding colours and the use of
9 glass (window) to make the sky show.
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19 [Figure 4 here]
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28 For lighting design, children suggested different colour lighting with different
29 shapes, (including star, leaf, and flower shapes) as well as various types, such
30 as spot lights and hanging lights. Finally, for furniture type, the suggestions
31 were 'big bean bags', 'cushions', 'soft chairs', 'sofas', and 'hexagonal seats' that
32 can be set on the walls.
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41 [Figure 5 here]
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58 Children could present their ideas for change through modelmaking in groups
59 successfully. Although it was not possible for researcher to talk with all the
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groups because of time limitation, they shared the summary of their ideas in a written format on a piece of paper as follows.

- “We were going to make a 3 layered re-design of the studio. The first of which would be a forest wall and red floor with board games. The other 2 floors would also be board games. But in the end, we only managed to make [one floor with] the forest wall” (Figure 5a).
- “We made one design. Design was based on the outdoors. Inside our model we have clouds, cloud lights and fake grass with a blue sky. We also have a pond ring and some plants pots” (Figure 5c).
- “The colours we used were red, orange, hot pink, yellow, for the sunset and dark purple with light blue for the ocean. We also made a floor type of thing out of the wood. We cut some short and left some long” (Figure 5d).
- “There will be two parts. The first part has a projector so you can watch things. There are seats and plants there. The second part has TVs for learning and we will grow plants in there. There will be a bug open space with a window. There is a mirror, which will reflect light from the window and that will make plants grow.”
- “We created a nature studio...we used our imagination to make vines, roses and trees to give it the nature touch. We put 4 LG TV's in for learning...couches with cushions, were also put in...it turned out really nice and enjoyable. This is a great opportunity for other children to explore and have fun in our beautiful nature studio.”

4.2.2 Re-design of School Hall

This study was conducted with 45 Year 5 children as participants. Children mentioned that they like their school hall because the activities they do (including P.E and dining) as well as being spacious and having a skyline wall; however, they expressed their dislike for the hall being dull and plain. Children suggested that they would like to change the ceiling to be opened and closed to let light and air in. They also proposed the change for the walls and floor by adding more colours and patterns. Regarding the preferred colours, almost half of the children chose 'blue' and 40% selected 'red' and almost 30% preferred 'green'.

For changing the windows, they suggested making them bigger and colourful. Children asked for more 'natural light' and re-design of artificial lighting (e.g. LED, hanging lights, and colourful lights). For re-designing the walls, children suggested making them colourful- similar suggestion for re-design of the floor. Regarding the ceiling, they asked for a transparent ceiling that can be opened and closed.

[Figure 6 here]

Children also presented their ideas by making physical models in groups and writing notes to explain their models (see Figure 6). Some of their notes are as follows.

- “The model that we were making included cutting out shapes for the floor and making stairs out of clay. We were making a two-story hall with hexagons on the walls so we can [sit to] read or relax.”
- “Our model is a stage which comes out from the wall and has mini seats. There is an on and off button. There is also a galaxy wall.”
- “Our ideas are a platform for resting, more natural light, [and] abstract art on the walls.”

5. Discussion

5.1 Methods for co-creation with children

Innovative architects declared that they cannot create a school for the future by themselves; therefore, they consider participations of the school users as central to the architect’s agenda and talk about the child as the ‘addressee’ about instruction as the ‘soul’ of the building and the joy of learning, and the eagerness to achieve (Walden, 2009). Using methods and materials that match the child’s set of skills seems crucial to optimise the outcome of a co-creation session with children. The co-design process for the studies was educational and fun for children, contained activities that encouraged the children to feel ownership of the project from the very beginning.

As Doorn (2016) highlighted it is beneficial to set up a learning environment in which the children can learn from and give constructive feedback to each other. In these studies, working in pairs and groups provided this opportunity for children to share ideas and learn from each other. A review of the various methods shows that there are two main classifications used in research involving children: ‘evaluative’ methods and ‘creative’ methods (Ghaziani, 2009). There are a number of evaluative methods which may be applied. Photo questionnaires and interviews are effective means for eliciting evaluative comments about physical settings (Sanoff *et al.*, 2001).

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3 When children do 'create' visual data, the methods for free expression include
4 drawing and model making. 'The school I'd like' 2001 competition also used
5 model marking and drawings as methods to gather children's views in 150
6 primary and secondary schools (Burke and Grosvenor, 2003). Model making
7 workshops with children were also used for the project named 'Joined up design
8 for schools' with involvement of around 100 schools and 700 pupils in client
9 teams (Sorrell, 2005). Model making has benefits because, unlike drawing, the
10 materials can be easily moved around until the child is happy with their decision
11 of where to place something. Drawings however require a commitment that is
12 not so easy or flexible to erase (Hart, 1979;1997). Physical modelling with a
13 variety of materials is an effective method to explore the learning environment
14 through children's perceptions and to understand what children find important in
15 their surroundings. This method is fun and allows children to really enjoy putting
16 their perspectives across; however, it takes time (often several hours) and
17 children should be allowed to complete their work (Johnson *et al.*, 2014).
18 However, using several data collection methods beside model making is
19 challenging in a school day because of time limitation and working with many
20 children; therefore, it is hard for children to create complete models with all the
21 details as these studies revealed.

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26 To increase the validity of data, researchers use a combination of methods of
27 data collection (Lewis and Lindsay, 1999). Alison Clark's Mosaic Approach
28 suggests a meaningful exchange of opinions between children and adults in a
29 participatory design process (Clark, 2005). It includes various activities and
30 methods to accompany children's numerous ways of expressing themselves,
31 which has been inspired by Reggio Emilia's hundred languages of children
32 theory (Hewett, 2001). Therefore, for these studies incorporating various
33 methods (questionnaires, drawings and model marking) for children to allow
34 self-expression helped the researcher to understand the story behind children's
35 drawings and improve the quality of data analysis. However, **children's
36 discussion during completing the questionnaires and sharing their responses
37 (as children have been close to each other around the tables in the classrooms)
38 might be a disadvantage of questionnaires. Drawings with some notes have
39 been an effective method for children to express their views (individually and in
40 pairs) as well as model making in groups (with notes to explain the drawings). In
41 addition, it was observed that despite the use of different methods, children's
42 responses were convergent. Overall, the studies revealed these three methods
43 could engage with skills and abilities of children; however, more research is
44 needed to gather children's views about these data collection methods.**

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49 It needs to be mentioned that for creating visual data and suggesting changes,
50 the presentation (**stage zero**) was significantly important as the analysis of
51 children's drawings, models and questionnaires demonstrated inspired new
52 ideas and raised issues related to the examples (images) presented to them;
53 therefore, it might be a vital stage to be included in gathering views of children,
54 especially at primary schools, in order to nurture and inspire children's
55 innovation and creativity; **however, it was identified that the researcher's
56 agendas to some extent shaped the responses of children. In addition, the
57 power gap between children and the researcher was bridged by informing**

children about professional conventions of model-making and drawings and assisting them to express their views.

Finally, the studies revealed that flexibility (for time and task plan) to work with a large number of children is needed as children have got different **interest and pace** in various methods to be involved (**resulted in a smaller number of questionnaires, drawings and model making for the second study**). Although these data collection techniques worked well for these studies before the pandemic, other methods (possibly online) may need to be explored for **post-COVID** time as access to the schools and contact with children in the schools would be more challenging for the researchers.

5.2 Children's views

In designing schools, it is important to recognise that a new building is not the finished product and even in the short-term good school buildings need to allow children to take ownership, experiment and change how they use the space (Mirshandani and Wright, 2016). Considering the previous studies, there have been similarities between the findings of this study and the issues emerged from analysis of previous studies (The School I'd Like, Joinedupdesignforschools, The Young Design Programme) in the UK (Ghaziani, 2008).

Although there have been concerns for contemporary school gardens because of modern childhoods that children being disconnected from nature (Williams and Brown, 2012), children presented their interest to be connected to nature and natural features (**biophilic design**). The findings had similarities to what 'the school I'd like' 2001 competition emphasised about children's ideas for their school yards - lots of spaces to be filled with ponds and gardens. With younger children, there was a further theme expressed, which was the need for more natural features, including water, wildlife and animals (Burke and Grosvenor, 2003). Similarly, analysis of previous studies presents children's interest to access to the landscape (e.g. trees, garden, mazes, grass, wild garden, ponds) and inclusion of seats, a pet corner or bird boxes in the school ground (Ghaziani, 2008) as also highlighted by children in this study. Although this study provides additional details related to the garden design in primary schools, it could be considered as a pilot study because of the limited number of children participated.

The importance of garden design in primary schools and the effective connection to nature for children's mental health is even more important for post Covid school design. School ground could be more important than before, not just for outdoor learning, but also for break time. The evidence shows that being outside reduces transmittance of the virus; therefore, schools can take advantage of this and exploit the opportunities for outside space. It also has been highlighted as one of the design considerations for school design to include more outdoor learning through external classrooms - greater consideration of the principles of forest schools, particularly for younger children (Waite, 2020). The 'protective measures' outlined in the guidance say schools

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3 should be looking to teach children outside more often as Tom Waddicor, an
4 associate at Maccreeanor Lavington Architects believes exterior space will
5 become 'ever more valuable in schools' and would be an opportunity 'for a new
6 wave of innovative outdoor classrooms' (Waite and Ing, 2020).
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9 Regarding the interiors, the emerged similar issues were 1) the interior is softly
10 textured (e.g. carpet), 2) the walls and floors are colourful, 3) the interior
11 provides means to display art work, 4) there is some decoration in the dining
12 spaces. The emerged similar items related to comfort and control based on
13 previous studies include 1) satisfactory levels of natural light (windows, sky/ roof
14 light), 2) appropriate types of artificial lights (e.g. spot lights), 3) natural
15 ventilation, and 4) provision for air-conditioning. Moreover, connection to nature
16 (**biophilic design patterns**) was important in interior spaces for children in this
17 study, which has been emerged in previous studies - a view to nature when you
18 are inside the building (e.g. plants, trees). In addition, related to furniture, similar
19 emerged issues from previous studies (**Ghaziani, 2008**) support the findings of
20 the second study – providing appropriate chairs (soft cushioned).
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24 Despite the similar finding, the previous studies have not been specific about
25 multi-functional spaces in schools. Therefore, the study of two interior spaces
26 provides insight into multi-functional spaces in primary schools for designers
27 and architects to include children's views in design process (for renovation and
28 future school design); however, post-COVID school design needed additional
29 considerations as not all children would be together at the same time for
30 assembly, dining and other activities. In addition, almost every space in future
31 schools should be considered as a multi-function space in order to keep
32 children together in 'bubbles' (with their teacher) throughout the day and
33 minimise contact and mixing; Therefore, flexible and adaptable design of large
34 shared spaces in the primary schools, including school halls and dining spaces
35 would be essential. In addition, selecting appropriate materials for various
36 surfaces and furniture that are easier to clean and do not support bacteria and
37 viruses is essential. Finally, more research focusing on diverse spaces, various
38 age groups and in different primary schools would provide reliable and age-
39 appropriate guideline for future school design.
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44 **6. Conclusion**

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46 As education system is changing (especially after this pandemic), future schools
47 need to deliver flexible and adaptable buildings; therefore, an engagement
48 process that allows for vigorous dialogue between designers, building users
49 (including children) and educationalist is needed (Mirshandani and Wright,
50 2016). On the other hand, educationalists and children should be completely
51 involved in the design process, actively participating both in the creation (or
52 transformation) and the maintenance of their learning environment. Architects,
53 landscape architects and support professionals must become hands-on
54 facilitators and leaders of thoughtful and relevant change – or must work with
55 those who are and can (DfES, 2006).
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3 As Walden (2009) suggests, schools of the future should take the experiences
4 of children into consideration as their buildings and outdoor spaces are planned;
5 however, review of literature suggests that the majority of studies have been
6 focused largely on school buildings because architects or landscape architects
7 are not often involved in helping schools develop school grounds into places of
8 biodiversity and experiential learning, and this is mainly undertaken by schools
9 themselves. In addition, there is usually lack of money in schools for non-
10 essential spaces, such as school gardens.
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13 Spatial production is a collective forming process which empowers architects
14 and users alike as Petrescu (2012) highlights. Listening to children's opinions
15 and their creative input is beneficial for the school design process and will help
16 create stronger and more effective outcomes. Children are capable of
17 articulating their views about their school environment in different ways. As
18 emerged from the studies, use of various data collection methods, including
19 questionnaires, drawings and model making work effectively with Y4 and Y5
20 children (8 to 10 years old). Although co-design with children encourages and
21 challenges researchers, designers and children to work together outside of their
22 own comfort zones, it enables them to acquire new knowledge based on a
23 mutual learning experience, which forms the basis for idea generation.
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27 Allowing children to express their views about different spaces in their schools
28 through methods that are familiar to them will enable designers and researchers
29 to design better schools in future for children as the ultimate clients. However,
30 more **research is needed to explore various methods of data collection with**
31 **children to gather their views about these methods.** The findings suggest that
32 some consistency in children's views was apparent; however, **more data**
33 **analysis should be undertaken with a larger number of children to explore** their
34 views further in order to make a framework for school design. Such research
35 could bridge the gap between designers' assumptions and children's views
36 about what is important in a school and consequently play a significant role in
37 improving school design and increasing child satisfaction. In the future, it would
38 be interesting to explore how the child's role as a main driver of the design
39 process could be developed further, and more age-appropriate research
40 methods (for evaluation and creation) with children in different years and
41 appropriate for post-COVID can be used in primary schools.
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45 Finally, the findings highlight the importance of involving children in the school
46 design process that could then inform the decision-making processes of
47 architects, designers **and educators** to look at problems from a child's
48 standpoint. **It is also important to gather views of teachers and involve them in**
49 **the design process.** The study demonstrate how research can be embedded in
50 primary/elementary schools for improving the existing learning environment
51 (buildings and grounds), possible renovations and extensions in schools **and**
52 **incorporating biophilic design.** It is recommended to gather children's and
53 teachers' views related to the changes that primary schools in the UK have
54 applied in response to the pandemic since June 2020 to assess the impact of
55 social distancing in various indoor and outdoor spaces. It is also recommended
56 that designers examine the inclusion of flexible and adaptable schools for
57 children and teachers with consideration of their needs, preferences, health and
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well-being. Therefore, more research needs to be carried out to find out how outdoor spaces can be improved and if almost every indoor space should become a multi-function space; and what this would mean for large shared spaces, such as school hall and dining spaces and whether they could be used for small spaces for learning.

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Figures

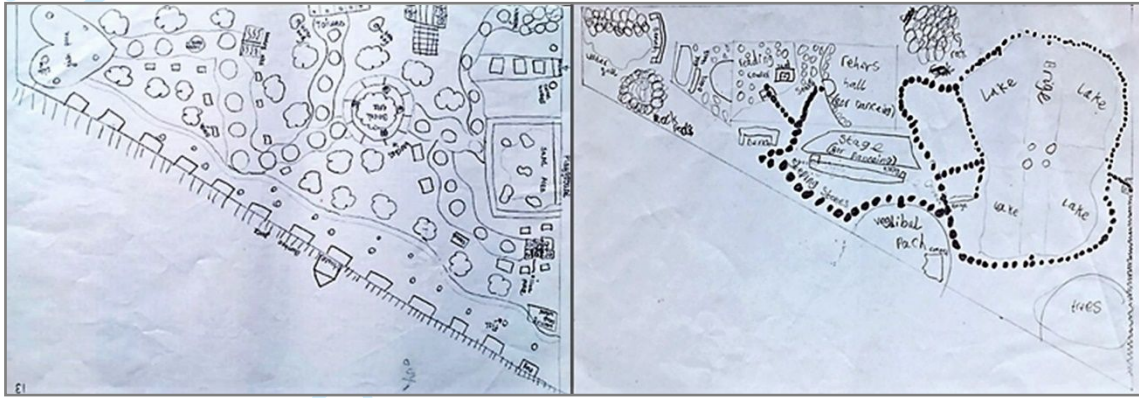


Figure 1



Figure 2



Figure 3

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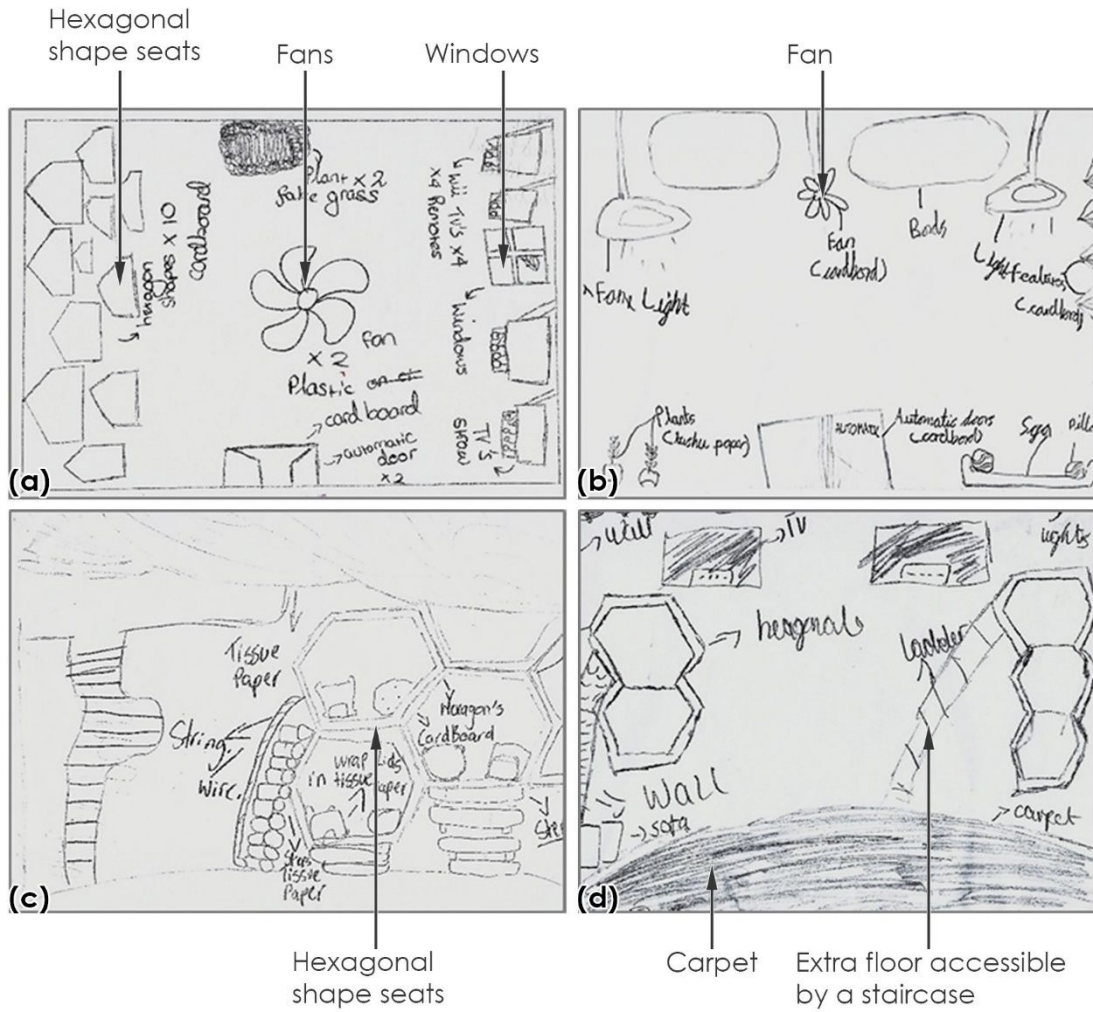


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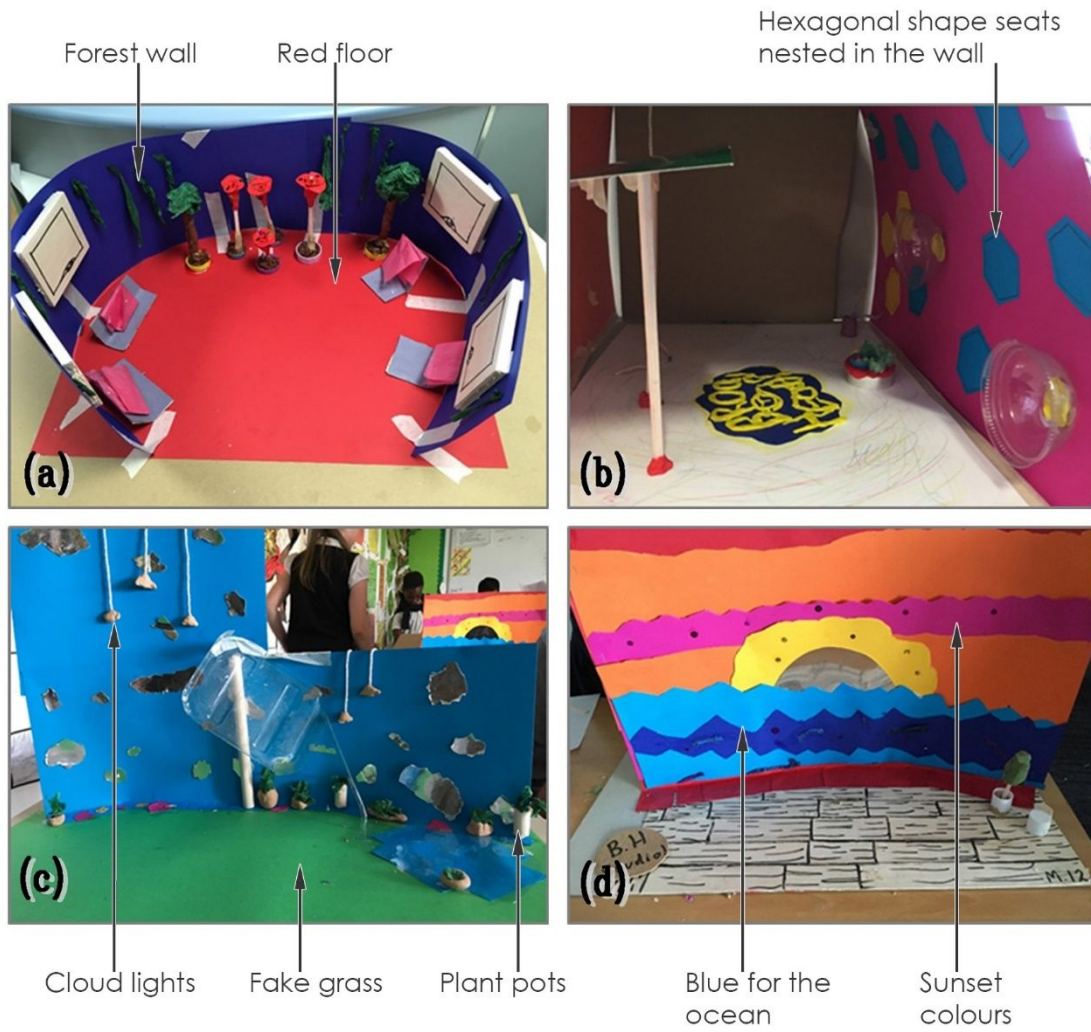


Figure 5

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Figure 6

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Figure 6. Children's models for re-designing the School Hall

Appendices

Appendix A: Questionnaire for Garden Design

1. What are the activities that you will have in your garden?
2. How does your garden respond to different senses?
 - Sound
 - Touch
 - Sight
 - Smell
3. What features would you like in your future garden?
 - children's play area
 - grasses
 - garden
 - evergreen
 - shade
 - landscape lighting
 - flower garden
 - 4 season interest
 - Sculpture
 - Fence
 - Gate
 - Benches/seats
 - Paths
 - Other
4. What materials do you used in your garden?
5. Do you think this garden make you happier?
6. Do you think this garden help you feel relax?

Appendix B: Questionnaire for Re-design of School Hall and Studio

1. What do you like most about your Hall/Studio?
2. What don't you like about your Hall/Studio?
3. What would you like to change and how?

What would you like to change?	How?

4. Describe your 'dream Hall/Studio' that you would like to have in your school.
5. What colours will you choose?
6. How do you re-design the walls?
7. What artwork do you include in your design?
8. How do you re-design the floor?
9. How do you re-design the ceiling?
10. How do you design the lighting?
11. What type of furniture would you suggest?