Developing an "ecology of learning" within a school sustainability co-design project with children in New Zealand

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This paper analyses the inter-relatedness of layers of involvement, as contributing to learning, within a school sustainability project (the eco-classroom project). This engaged students, staff and community members (including professional practitioners) in an architectural co-design project that resulted, after 4 years, in a built classroom. The paper utilises an "ecology of learning" diagram to indicate layers and show connections, which are evidenced by findings from the project, alongside relevant literature in geographies of architecture and childhood, pedagogies of sustainable learning and children's participatory and co-design examples. In conclusion, the ecology of learning approach is critiqued and encouragement of more sustainability co-design projects with children is recommended. It is proposed this could lead to improved processes for all participants while promoting authentic and relevant sustainability learning.

Keywords: co-design; participation with children; education for sustainability; school-based learning; architecture

Introduction

This special edition addresses children, young people and sustainability globally, but under a local lens. The call for papers stated that while this demographic has capability for developing caring for, and engagement with, environmental issues, they are often not included or involved within policy-making regarding key sustainability issues, for example, climate change adaptation. Engagement with local, action-taking environmental projects, especially assuming an advocacy role or engaging politically within environmental projects, is believed to encourage active, critical learners (Jensen and Schnack 1997). It could be argued that such learners are better equipped to engage in sustainability issues and more likely to seek opportunities to do so. A political stance lends greater authenticity to a project, while a local focus gives greater relevance for children (Chawla and Cushing 2007). Children spend considerable time at school, and global documents such as the *Tbilisi Declaration* (UNESCO 1977) and the Earth Summit's programme of action, *Agenda 21* (UNESCO 1992), established the primacy of environmental education (EE) in schools, latterly emphasising the multi-disciplinary nature of environmental sustainability and the importance of active participation for learning.

This paper demonstrates the inter-dependency of local (i.e. school and immediate community) involvement and its effect on children's environmental learning due to participation

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in a school-based education for sustainability (EfS)[1] project in New Zealand. The eco-classroom project emphasised EfS action as the issue, democracy as the mode, architectural design as the process and local community as the sphere of involvement.

The eco-classroom project was ambitious in its management throughout the 4 plus years it took until construction of the building, and in the fact that the majority of learning was curriculum-based. In New Zealand, the most recent national school curriculum promotes sustainability through its vision, cross-curricula themes and espoused values, but it stops short of making it a compulsory subject (Ministry of Education 2007). As a result, the eco-classroom project represents an example of integrating sustainability education within a formal education curriculum, even when it is not explicitly prescribed, and including children actively in sustainable design of their environments. Although a relatively small project, it has potential to add to an area of increasing academic interest, but limited case studies.

The paper relates relevant literature within geographies of architecture and childhood, pedagogies of environmental sustainability and examples of co-design with children to the context of the eco-classroom project. The project background is explained, followed by an overview of the research method employed. Consideration of the layers of involvement and commensurate learning within the project is presented via development of an "ecology of learning" diagram that emphasises the dynamic and local focus. In the conclusion, this approach is critiqued for its depiction of relationships and learning within the project and its value in informing future sustainability co-design projects with children.

Literature review

Geographies of architecture and childhood

At the heart of the eco-classroom project were notions of place-making, which Kraftl (2010) reminds us is a fundamental embodiment of buildings. The early identification by students at the school of the need for a special place in which to learn about environmental sustainability and to welcome community members, grew into a design and build project. This engaged students in an architectural process that explored sustainable or low-impact design options as a primary consideration. The resulting building embodies past, present and future meaning associated with this, as reflected in the children's name for it – the "Living Room". Lees' (2001) call to recognise that this fundamental connection between people and place embraces cultural, symbolic and political meanings, resonates with this, especially by regarding architecture as a lived rather than representational form. Extending this, Kraftl (2006) considers how the materials of a school building are imbued with the ideal of a Rudolf Steiner childhood, which connects geographies of architecture and geographies of childhood and reveals a focus on adult-led ideals and decision-making. In this example, the material geographies of the school embodied the educational beliefs and aspirations of the makers, who were mostly parents. In the eco-classroom project, these geographies were more of the children's making, with their decisions including, for example, low windows for outdoor views while sitting on the floor and coloured Perspex in high-mounted windows to make bright patterns.

The paper will not draw heavily on literatures of architectural and children's geographies. However, they do provide a valuable critical lens through which to view this project involving children, architecture and sustainability, each of which bears a hefty social responsibility and contains many contested aspects. For example, since the proposal

in the late twentieth century of the new social studies of childhood there has been a shift towards regarding childhood as a social construction (Holloway and Valentine 2000). In the inaugural editorial of *Children's Geographies*, Matthews (2003) describes the many facets to the "geographical worlds of children" (p. 3) and highlights the tendency for a "crisis of representation" (p. 5) that can lead to viewing children as adults being formed rather than children being. Evans and Honeyford (2012) pick up on this debate with regards to children and UK sustainable policy. They caution there is a risk in anticipatory or futurist[2] policy, of children's rights being unattended to due to greater emphasis on the rights of the adult they are being moulded into. Some of this focus, albeit well-intended, is captured by the following quote from the eco-classroom project:

> ... there were processes to go through, Ministry of Education requirements and local council requirements for building permits. ... they had to develop an understanding of how adults work. (School Principal interview)

This is picked up again in Research Findings.

EfS pedagogy

Action-taking projects that are *for* the environment are viewed as having greater potential to permanently change attitudes and therefore behaviour towards the environment through learning transformations (Fien and Greenall Gough 1996). Jensen and Schnack's (1997) action competence (AC) approach to EE in schools suggests an on-going process of learning that is dynamic, emancipatory and transformative through its action-taking, democratic and political focus. Defining actions as intentional, competence as students' abilities to act and democracy as participation, AC focuses on student-led projects about actions that deal with environmental solutions, not adult-driven activities towards environmental symptoms (Jensen and Schnack 1997). Although it was proposed some years ago, the resilience of AC as EE developed into EfS is attested by Mogensen and Schnack (2010), who liken it to the German concept of *Bildung*. This describes development of a higher level of education through socialisation and social conscious rather than personal knowledge building, therefore linking it with socio-constructivism through the emphasis on knowledge sharing and collaboration (Vygotsky 1978). Ecological modernisation is currently a popular model of environmental consciousness (Laessoe 2010). When viewed through an AC lens, it requires shifting from valuing individual facts and individuals' skills to holistic embracing of real situations in a rich collective of participants' integrated knowledge, skills, reflection and action (Mogensen and Schnack 2010). Such projects, as aspired to by the eco-classroom project, therefore aim to empower school students through ownership of authentic projects and associated decision-making, in a democratic environment.

Within current significant life experiences (SLE) research, a political and democratic model of EE is also recommended for development of pro-environmental behaviour (Chawla 2008). Like AC, there is an emphasis in SLE on collective learning and group confidence over personal competence in action-taking environmental projects (Chawla and Cushing 2007). This implies greater focus on the learning process than project outcomes.

In summary, these experiences that contribute to AC and SLE may, through learning transformations, position children as capable actors in an uncertain and un-sustainable world. Because transformative learning came originally from the emancipatory work of Freire (1993) and Mezirow (2000), it is linked to AC and SLE through the imperative of

learner empowerment via collective knowledge. The level of participation or democracy that is allowed and the way this is managed will have an important bearing on the outcome, as identified in the following section on co-design.

Co-design with children

Major barriers to children's participation are adults' willingness to allow it, followed by its interpretation and enactment. Hart (1997) and Driskell (2002), among others, have highlighted the potential for participation to be token. With regard to participation in design, Iltus and Hart (1995) comment that many adults lack conviction about children's capability to plan, design and build, although in some recent examples practitioners have attested the skills children brought to the design table (e.g. Chiles 2005, Sorrell and Sorrell 2005, Sancar 2006).

Koralek and Mitchell (2005) acknowledge that children are natural designers, being free of the constraints adulthood brings. However, they also lack knowledge and skills to achieve a complex built structure. Within SLE and participatory research with children (e.g. Hart 1997, Driskell 2002, Chawla 2008) it has been established that adult role models are needed to scaffold learning. Mannion (2007) cautions against making the dangerous assumption that children are like adults in thinking and behaving, thereby ignoring the critical adult dimension within participatory processes.

Providing an authentic co-design and build experience for children is challenging with the budget and timeframe constraints of most real projects. Perhaps for this reason, Koralek and Mitchell (2005) note that examples are still sparse, although Malinin and Parnell (2012) point out this is on the rise. In addition, the concept has received recent attention as a valid process of student empowerment and contribution in renewed school building programmes such as the UK's Building Schools for the Future (BSF) (Burke 2007). BSF, cancelled in 2010, has been widely analysed and critiqued (e.g. den Besten *et al*. 2008, Newman and Thomas 2008, Parnell *et al*. 2008). The massive scale of the programme meant there was considerable variation in the way it worked within individual schools and unfortunately little detail has been published on actual methods used, as a useful comparison to the eco-classroom. Its relevance to this project is therefore limited to its stated intention of student involvement in school design decisions with a sustainability focus (Wheeler 2009). However, arguably the most enduring effect of BSF has been to mainstream the potential of students working with professionals as a learning and empowering device that can positively influence schools of the future (Burke 2007).

The guideline report, *Designing New Schools: Summary of Findings* (Parnell *et al.* 2009), which is principally about BSF, provides a useful definition of co-design in this context. Co-design is where users work directly and collaboratively with designers rather than indirectly by providing information to be considered by designers or working on sub-projects (e.g. landscape). The eco-classroom project involved both direct and indirect experiences, e.g. younger students designed a water feature to collect rainwater.

Background to the eco-classroom project

Enviroschools Programme

The project was carried out under the Enviroschools Programme, a national programme managed by the Enviroschools Foundation, a charitable trust. The programme is available to all New Zealand schools, from pre-schools through high schools. The Enviroschools

Programme emphasises development of participation and a strong sense of place and purpose and connects this through an action-learning cycle to encourage real-world, action-taking projects that are locally relevant (The Enviroschools Foundation 2008). The programme subscribes to Driskell's (2002) shared decision-making (between children and adults) dimension of participation and advocates a whole-school approach. Tilbury and Wortman (2006) emphasise the potential inclusiveness as well as the wider community aspect of this approach. Evidence of this approach is in the vision-mapping that schools carry out with potential input from the whole school community. As a result, every school's journey is different and resources such as the Enviroschools kit (The Enviroschools Foundation 2009) and an assigned Enviroschools Facilitator per school help teachers to work within the programme. This latter distinguishes the programme from others, e.g. Eco-Schools England (n.d.) in the UK, Learnscapes (n.d.) in Australia and the Australian Sustainable Schools Initiative (AuSSI n.d.).

Eco-classroom project

The study school is a public primary school situated in the suburbs of a New Zealand city with 600 enrolments aged 5–11. Its government decile rating of 10 (highest) reflects the high socioeconomic neighbourhoods it draws its student body from. Since late 2005, a changing group of students, who had chosen EfS electives[3] at the school worked on an architectural project to co-design and co-construct a classroom utilising recycled and environmentally sustainable materials and technologies.

Following the early investigative work, a concept plan and model of the eco-classroom was developed in 2006–2008 led by the students' research and decisions, in conjunction with the lead EfS teacher ("teacher") as facilitator, a local architecture firm and specialists from the community. The teacher also had considerable support from school management, other teachers, parents and the parent teacher association (PTA). The students had the multiple roles as learners (in energy conservation and principles of environmentally sustainable building), contributors (through research and experimentation), and clients in a design process. The set-up of a working party of 12 students (6 each from the school's two senior year groups – aged 9–11 years) in 2006 helped keep the project momentum going between electives. This group was chosen by the project teacher for their interest and motivation in previous EfS electives or initiatives within the school. While this prescribed the involvement of certain students, by adults, the working party was needed to straddle the elective classes, which in contrast, students chose to join. Lunchtime and after-school meetings were held as required, facilitated by the teacher. Selection into the working party was regarded by students as a privilege.

Detailed drawings followed and tender documents were prepared in 2009, supported by the architecture firm and a project manager. The building opened in December 2009, although new projects associated with it are ongoing.

Learning within the project

The project followed the Enviroschools action-learning approach (see The Enviroschools Foundation n.d.). Students learnt in groups, working on activities that contributed a small part towards the eco-classroom. For example, early groups researched building function and established a site. Later groups investigated thermal properties of materials and organised fundraising[4] activities. Still later groups prepared environmental impact reports and made mud bricks for use behind the fireplace of the classroom. Final groups helped

with construction, to a limited degree, e.g. installing insulation. Specialists came in to assist as required (e.g. mud brick-makers) or field trips were made for ideas and assistance. The architectural firm remained a constant local expert throughout the project, with meetings at the school and their offices. The Enviroschools Programme provides a kit of learning activities that teachers can modify (The Enviroschools Foundation 2009). In this project, the teacher also used an emergent curriculum, inquiry-based, learning process which enables the curriculum to emerge from student interests, rather than being pre-planned (Durno 2009). Thinking skills activities were also widely used, e.g. Edward de Bono's *Six Thinking Hats* (see de Bono 2007).

Research project design

A qualitative method of narrative inquiry (Clandinin 2007) was chosen, whereby participants' views or stories were collected and analysed. Children's and adults' voices were included as their respective contributions enriched the outcomes of the project. Ethics approval for this was obtained. Data gathering was framed by student learning as knowledge (cognitive), skills (psychomotor) and attitudes and values (affective). Mapping these pedagogical factors alongside the four research aspects of participation, EfS, design and community involvement developed a matrix framework. The method was flexible to allow for emergence of other outcomes, e.g. adult experiences.

Data were collected in three ways. In November 2008, two focus groups, using semistructured questions, were held with six students each from the then-current working party. Questions were organised with the matrix framework explained above. Student names and the name of the school are replaced by pseudonyms in this paper. Parents of these students completed questionnaires at the same time. In March 2009, individual semi-structured interviews were conducted, one with each key adult stakeholder (architect, project manager, school principal, teacher, Board of Trustees [BoT] member and Enviroschools Facilitator). These interviews examined the adults' experiences with the project, and their views about student learning through the project and the value of the project itself. Focus groups and interviews were audio taped, transcribed and then data were manually coded into recurring themes that arose both inductively from the data and deductively from the literature-informed framework.

Data were also collected informally. First, through classroom observations (seven occasions), which enabled understanding of how learning occurred and the project was managed. Bryman (2004) acknowledges these are valid ethnographic data and can include serendipitous events that feed valuably into the research. Second, via access to the teacher's visual diaries that documented the process, which was invaluable for seeing the history of the project since it had already been running for 2 years.

Reflections on research design

It is relevant to identify some constraints due to the research method. On reflection, it was felt that the focus groups with students should have happened after the interviews with key adults. Interview data were very rich due to participants being adult, educated and very positively engaged with the project. This gave a lot of insight into the project, which could have informed the way the focus groups were conducted. A further recommended change would be to interview parents rather than use a questionaire. In general, the data generated were not very rich due to questions being mostly closed.

It is also important to acknowledge that students participating in the research were more involved in the eco-classroom project than many students at the school. This was a deliberate choice. However, this fact coupled with the high socioeconomic demographic of the school is a potential limitation to transference of the findings to other contexts.

Research findings: development of an "ecology of learning"

Research findings showed that the eco-classroom project developed complex relational layers that contributed to the EfS learning outcomes, and which emerged through the local and democratic focus within the project. The interdependency of people's roles within the project led to both predictable and non-predictable outcomes, which resonate with the current worldview of ecological systems being dynamic, non-linear and giving rise to emergent outcomes (Krasny *et al.* 2010). When a human dimension is added, the resulting social-ecological system is said to show its resilience by the way it manages, adapts and grows from change, the same as the transformative learning capacity favoured within EfS (Krasny *et al.* 2010). Situating human pedagogical development in an ecological frame is not a new idea (e.g. see Bronfenbrenner 1979, Horelli 2006, Chawla 2008). We have therefore called the layering within the eco-classroom project an "ecology of learning" (Figure 1). The following sections discuss the integral nature of each layer and its connectedness to the whole that constitutes the eco-classroom project. It is important to note that the hierarchical organisation in Figure 1, as depicted by the nested layers, is a consequence of the project being carried out in the formal learning environment of a school. However, the differently shaded arrows of connection indicate communication and connections between all layers in a non-linear way.
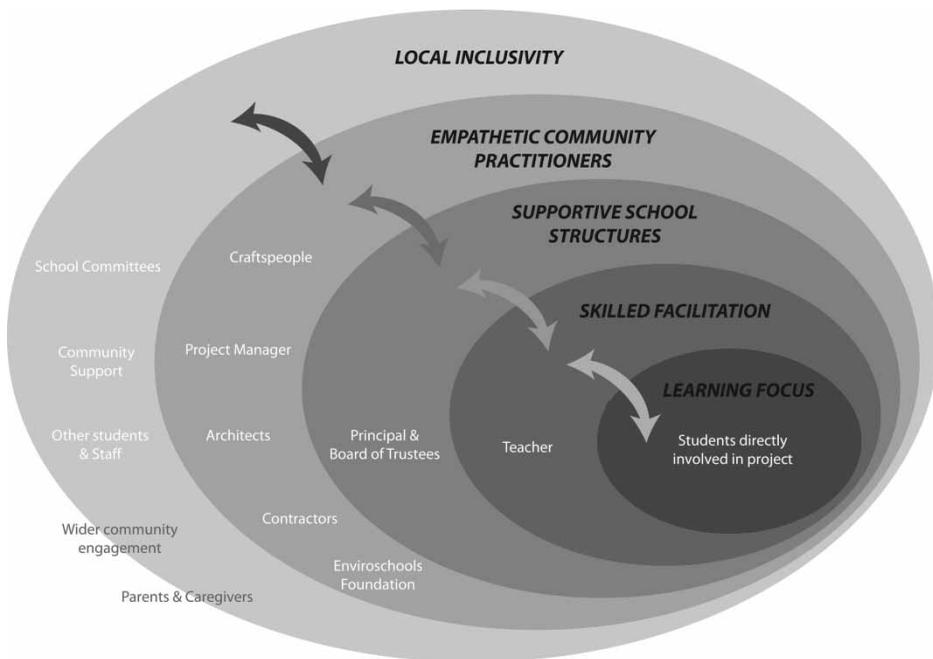

Figure 1. Development of an "ecology of learning" in the eco-classroom project showing the interdependency between layers of involvement within the project.

Learning focus

The eco-classroom project kept student EfS learning at its core, through the requirement that the whole project fit within the New Zealand School Curriculum. Its action-taking focus, alongside a democratic commitment to student participation, fits with an AC approach as described by Jensen and Schnack (1997) and with recent SLE research (Chawla and Cushing 2007). This was driven both by school values (see section "Supportive School Structures") and the philosophy of the Enviroschools Programme (see section "Empathetic community practitioners"). Data from the focus groups gave indication of learning transformations, as proposed by Fien and Greenall Gough (1996). For example:

> I learnt lots of skills from this like evaluating, and like green star ratings, but it also has . . . made an effect on home, like switching off heaters. (Milly, Focus Group 1)

Students were also emphatic that they preferred this style of learning, for example:

> I think it's really really different because here we get to say what we want to say whereas in maths . . . we have a subject and have to do what the teacher says, but here, like, we have our own say. (Joseph, Focus Group 2)

Meanwhile the importance of social interaction on learning, as reflected by the concept of *Bildung* (Mogensen and Schnack 2010), is captured by this quote:

> At home . . . I feel quite alone since I'm the only person who wants to help the environment. But at school it really changes because I've got a whole group of people. (Tania, Focus Group 1)

Students gave evidence that the long-term nature of the project also created intra-generational synergies. For example:

> Like my brother was in this project before me and I didn't understand what he went on about . . . but now I'm in the project too, I realise all the things he's talking about, so with me and my brother it's making our family better. (Jacob, Focus Group 2)

The authentic context of the eco-classroom project, resulting in a usable building within the school and community, gave pedagogical meaning to the learning and opportunity for strong community input. For example:

> You get to learn more about the environment and we get to do presentations and um we learn stuff too from people who see our presentations. Like we got taught from this energy efficient guy about microwave clocks and light bulbs and solar heating. (Sam, Focus Group 2)

Experience at presentations was something several students mentioned as evidence of the cross-disciplinary learning that the project enabled. For example:

> I've got skills from the actual talking in front of everybody, because well, that's quite an important skill for most jobs when you're older . . . (Mark, Focus Group 1)

This benefit was also attributed to co-design projects with school students within the joinedupdesignforschools programme in the U.K. (Sorrell and Sorrell 2005).

Political engagement and advocacy is considered imperative within both SLE (Chawla and Cushing 2007) and AC (Jensen and Schnack 1997, Laessoe 2010) in order to develop critical understanding of issues of environmental sustainability. This was evidenced in student learning within the project when students described a recent Green Lunch (a sustainability networking tool) they had hosted. A prominent member of parliament had been invited but he came late and left early to open a new computer block in another school. Students expressed disgust with this lack of endorsement of their EfS project. For example:

> [MP's name] arrived late and didn't stay long enough. He chose technology over environmental education and didn't learn anything from the environmental education talk. (Sam, Focus Group 2)

The learning priority of the project, coupled with its long-term nature, meant it was a process-focused rather than outcome-driven approach, in agreement with architectural co-design literature (e.g. Blundell Jones 2005, Hubner 2005, Sorrell and Sorrell 2005, Sancar 2006). In addition, AC (e.g. Jensen and Schnack 1997, Breiting *et al.* 2005) and SLE (Chawla and Cushing 2007) both support this focus. The project architect explained it as:

> . . . the building probably doesn't reflect the spirit of what the whole thing has been about. . . . actually the process has been far more important. (Architect interview)

although students were clearly motivated to see the final result, saying:

> The good thing is that now we've been part of it, we get to build it next year. (Jessica, Focus Group 2)

Both a local focus and a strong element of fun (see section "Skilled facilitation") were valued, in agreement with Chawla and Cushing's (2007) recommendations within SLE research, for example:

> I think the thing about the mud bricks . . . because it is relevant to this school (. . . collecting different [clay] samples from around the school), and it's hands-on and fun and using their environment. (Enviroschools Facilitator interview)

In reciprocation, students appreciated the fun elements such as this within the project, saying, for example:

> It's fun but we've probably all of us learnt heaps. (Jessica, Focus Group 2)

> and

> We got to be on TV one time and so it was pretty cool. (Vincent, Focus Group 1) (see Figure 2)

A particular challenge within this project, and identified negatively within BFS (e.g. den Besten *et al.* 2008), was student turnover with the long-term nature of the project creating issues of potential lack of continuity. This occurred when students who were involved finished at the school. A student peer education process, similar to one described by Shier (2010), was successfully used by the teacher (see section "Skilled facilitation") in conjunction with thinking skills that incorporated reflective practices. She explained:

Figure 2.   Students being interviewed by a television channel about the eco-classroom project during a mud brick-making workshop, 2009. (Photograph by the author)

> [Older students] were the mentors . . . the knowledge basket. The new students knew a little bit but not enough to carry on. So they would have targeted questions that they would have to think about while the [older students] were presenting, e.g. "what is the evidence of student planning?" (Teacher interview)

Skilled facilitation

Research findings clearly revealed that the eco-classroom project was essentially led by the skilled facilitation of the teacher at the school, who explained the process as:

> . . . the key thing is that it is their own initiative. It can be very tempting to want to totally direct students. But once you do that, they are very quick to realise that it's not their project anymore. . . . As the teacher we are the facilitator . . . there is some guiding for sure. They are in control. . . . being involved in all the steps . . . (Teacher interview)

This seemed to be a mutual perception, as evidenced by:

> The only adults that are involved are the architect, teacher and some other people, but the kids are the ones thinking of all the ideas, there aren't just adults there thinking of it. (Mark, Focus Group 1)

although one student did reveal the vulnerability children clearly feel in this role, saying:

> . . . we're actually lucky to have [the teacher] because she's really helped us run this . . . I mean we're only kids but she's helped us to get things. (Tania, Focus Group 1)

The BoT member captured the role of the children within the project when he said:

> . . . definitely it's kid-led, but . . . the processes are adult-crafted. (BoT interview)

This agrees with Mannion's (2007) view that it is important to acknowledge the importance of adults within co-design and other participatory processes with children. The teacher outlined the importance of adults having the final say in specialist matters (see section "Empathetic community practitioners"):

> Some things they [students] realise they have to leave up to the experts to make the final decisions. (Teacher interview)

As described under "Learning Focus", having fun was a key part of the journey, for example:

> . . . fun for me isn't just doing an activity, fun to me is doing something that they consider fun, but it also has a huge element of learning involved in it. (Teacher interview)

Parnell *et al.* (2009) identified skilled facilitation within BSF as essential, yet found there was commonly a piecemeal approach to managing this process. Establishment of trust and strong relationships were also identified by these authors as necessary to enable young people to have effective voice. In the eco-classroom project it was clear the teacher had the trust of students, for example:

> . . . with her helping us, we've grown from when we started. We've become more confident. (Callum, Focus Group 1)

In summary, these findings resonate with Carlsson and Sanders' (2008) recommendation of effective facilitation being seminal in student engagement and learning in EfS projects.

Supportive school structures

Research findings indicated a firmly established culture of valuing environmental sustainability that existed from school management down, as evidenced by it being written into the School Charter (Brookwood School 2009). For example:

> One of our learning priorities is that we are Brookwood School learners who become committed to sustainability and will practice it. (School Principal interview)

which led to students feeling supported, for example:

> . . . even though there are a few adults . . . they're thinking like us, so it's . . . really good. (Milly, Focus Group 1)

The eco-classroom project was therefore not a stand-alone EfS project, rather it was part of a school-wide sustainability focus, which is supported by the Enviroschools Programme they follow. Carlsson and Sanders (2008) identified a link between integration of EfS projects into the fabric of the school and student learning. The school has also developed a strong culture of democracy, either because of, or alongside, its role as an Enviroschool. The principal was supportive of this, saying:

> It doesn't matter about their age. [What matters is] that they have skills and ideas and things that they can contribute, and they just need to be listened to. (Principal interview)

This concurs with the report of Parnell *et al.* (2009) that BSF schools having an ethos of participatory practice were identified as being better equipped to provide participatory opportunities. Occasionally, there was a tendency to view participation as an opportunity for children to step up as adults (see page 3 and below), for example:

> ... a lot of consultation has to happen. ... for the children they quite like their here and now, and get things done. So that's been quite something for them to grasp. (Principal interview)

However, there were no comments made by students in the focus groups about feeling overwhelmed or disengaged as a result of adult expectations. Overall, it was clear that the principal genuinely valued the input of the students and regarded them as knowledgeable people about sustainable buildings. For example, serendipitously during a classroom observation session, the principal came to consult with students over sustainable features on classrooms other than the eco-classroom. He explained:

> We had to consult with the children. I went and presented to [them] and they raised questions about the design ... so its got extra insulation ... It comes at a great cost but we have to live out what we are saying. The children are challenging us on this ... (Principal interview)

This acknowledged students' learning in a way that made them feel valued, for example:

> It's like, influenced the school. (Joseph, Focus Group 2)

and

> I reckon that the learning at the school has changed. (Jessica, Focus Group 2)

In summary, schools tend to promote socially dictated adult roles and behaviours (Collins and Coleman 2008) and, problematically, this can become the focus of participation. Overall, in the eco-classroom project findings indicate school management had genuine intent towards giving students voice and encouraging and believing in their capabilities. They were also committed to sustainability as an embedded practice within the school, which led to the eco-classroom project having synergies with other EfS learning within the school. Such support aligns with Wooltorton's (2004) findings that stresses the influence of school management, especially principals, on behaviour changes within school communities towards the environment.

Empathetic community practitioners

The project reached out into the local community beyond the school to get specialist skills, for example, graphic designer for marketing, model-maker, project manager, the Enviroschools Foundation, builders and an architectural company to work with the students on the design. Every one of these had to embrace the participatory ethos and sustainability focus of the project although the most crucial and sustained input came from the architect. In other accounts of co-design projects with children a commonality is the passion and social-minded altruism of practitioners towards community, children and the environment (e.g. Blundell Jones 2005, Hubner 2005, Sorrell and Sorrell 2005, Sancar 2006). The eco-classroom project was no different, as illustrated by the following:

I absolutely love it. . . . The enthusiasm and liveliness of the kids is just wonderful. The disadvantage . . . is that it is not an economic proposition . . . We are doing it because . . . educating people . . . and the green environment is really important . . . And we have all gained a lot on a personal level. (Architect interview)

The community aspect of the eco-classroom project was crucial for learning because it provided skills and expertise and emphasised the real-life nature of the project. The architect had a key role in this. Findings indicated that he was a positive influence on the project due to his manner of working with students that made them feel included, valued and empowered. For example:

The architect is absolutely the right architect working with the children. Seeing them as equals . . . Called them his clients, consulted at all the different stages, but also revisited every new elective group that came in. They definitely felt part of the process. (Teacher interview)

and

. . . the architect when he did the plans he would always show us before he made any changes or if we wanted to make changes so we were always making the decisions. (Milly, Focus Group 1)

and

. . . but he didn't just go "oh no sorry, you can't have that because it's just not happening". He came back with a different idea. (Tania, Focus Group 1)

However, the eco-classroom architect expressed some disappointment in the final building shape and was frustrated that his responsibility towards compliance meant it had not looked more unique (see Figure 3):

I feel a bit of a party-pooper in some ways . . . having to say these are great ideas but we can't actually achieve all of the things . . . which means it has gone from something which might have been more creative, more colourful, more fun. And it's come back to a building which people would recognise as a building perhaps. . . . we've got something really rectilinear . . . that's what I don't like, it's an adult building in a way. (Architect interview).

This resonates with Kraftl's (2006) paper about parents creating an ideal Steiner childhood through the alternative architecture and detailing within the school which they created. In the eco-classroom project, the architect wished that childhood had contributed more tangibly to the design. This raises interesting issues about adult perceptions of childhood, as explored by Jones (2000) in interrogating the difference between adults' expectations and children's experience of childhood within a rural idyll.

Local inclusivity

For over 4 years, approximately 170 students were directly involved in the project, but many more people formed the local community both within and outside the school. The initial impetus for the eco-classroom project came via the whole school vision map, through the Enviroschools Programme subscribing to a whole school approach to environmental sustainability (The Enviroschools Foundation 2008). Tilbury and Wortman (2006) emphasise the

Figure 3.   The "living room" on opening day (December 2009). (Photograph by the author)

value of a whole school approach for connecting with the wider community, which was quite extensive in the eco-classroom project (refer Figure 1). The importance of keeping everyone informed was emphasised in the findings and one successful method used was a regular news-letter students helped produce. In their report, Parnell *et al.* (2009) identified communication as a success factor in a collaborative school design process and in the eco-classroom project there was also a focus on moving slowly, for example:

> . . . we did it in steps . . . over two years we informed our local community and we sought out experts in our local community and then with our Green Lunch we took it to the wider com-munity. . . . I think that our process made the local community feel empowered and it has also bought on board . . . people who want[ed] to help . . . and that included our local *iwi* [Maori] group as well. (Teacher interview)

Conclusion

The eco-classroom project was a student-led, adult-facilitated, action-taking school sustain-ability project, which arose out of a whole school approach to EfS project development. Within the typology of sustainable architectural co-design projects, it is comparable with other examples in the literature, and the research presented here offers valuable detail on method for future projects. Working between the delicate triangle formed by childhood, sustainability education and adult expectations, it is suggested the project succeeded in pro-viding authentic and relevant sustainability learning experiences for children, which aligned with pedagogical EfS concepts such as AC and SLE. The project led to learning transform-ations as indicated in the following paragraphs.

In critiquing the 'ecology of learning' approach, the diagram shows the inherent hier-archical organisation of the project. This highlights the sequential importance of each nested layer when planning an action-taking EfS project with children in a school

environment including community members and professional practitioners. It also goes some way towards showing the inter-dependency of the people involved within the project, which was evident from the findings section. For example, it was clear practitioners were reliant on the facilitation provided by the teacher, and the role of specialists in a project such as this is essential. Equally, the support of school management is paramount and a participative and sustainability focused ethos already within the school assists greatly in fostering strong democracy and sustainability learning.

It is suggested that the ecological concept has validity and the current diagram is useful for seeing how a project might fit together, but its current hierarchical and two-dimensional format cannot represent some of the underlying aspects of the project. For example, from the structure of the project both predictable and unpredictable outcomes emerged. This indicates flexibility and fits with the analogy of the deceptive simplicity of ecological systems and the transformative resilience observable in socio-ecological systems. Predictable were some of the findings from the students, such as the confidence gained, the cross-disciplinary learning, feelings of ownership in the project due to their ideas being valued, the importance of fun within learning, synergies in EfS learning from the social aspects and from reinforcement within families.

What was less predictable were the effects on adults within the project, with several indicating that their involvement affected them profoundly. Adult participants were unanimously surprised by the capability of students involved in the project. For example:

> I think I have grown hugely by being involved . . . seeing first hand what the kids were capable of . . . it's reminded me constantly of the potential children have and that we as adults need to realise that potential in every way . . . and never underestimate them. (Enviroschools Facilitator interview)

and

> I think just generally as adults involved we are a bit in awe of it all. How children can do that? (Principal interview)

This reciprocal learning does not fit easily within the 'ecology of learning' as currently depicted. What did fit was consideration of adult expectations, which did at times lean towards children acting as adults. However, this was tempered by the genuine attempt the project represented to enable students to actively work alongside adults to create a permanent structure imbued with their ideas and learning. It was also juxtaposed by the example of the architect wishing the design were more reflective of children (i.e. adult perceptions of childhood). From this arises a recommendation that more projects and research be encouraged in order to better manage the process for all participants.

Peter Hubner, the German social architect, said, "Buildings remember the story of their making" (as cited in Burke 2007). The eco-classroom architect likened this to the meaning and dynamism of historic community buildings such as cathedrals and tribal meeting-houses, which were built over multiple generations. Buildings like the eco-classroom, now aptly named the "Living Room", will continue to be built upon by successive groups of students with new projects and new ideas, while still preserving the original story. With regard to children and sustainability, the theme of this special edition, this project both engaged children as they are and adults as they will become. The architect reminds us that this is more important than any built structure, by pointing out:

What this is about isn't the project in itself so much. It's actually about what's happening to those students. You are ... building something into them and not the building itself, which has got a very important future. (Architect interview)

Notes

1. Called education for sustainable development in Europe.
2. As represented by sustainability since it predicts a future no one really knows.
3. Sometimes several electives were run per year.
4. The project cost of NZ$250,000 came from sponsors and fundraising.

Acknowledgements

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