



# Smart Green Schools

## The Unofficial Overview



There is an increasing willingness to move beyond the classroom and to adopt student-centred learning approaches with teachers working as teams



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# Introduction

## The Smart Green Schools Research Project

The Smart Green Schools project, an Australian Research Council (ARC) Linkage Grant (2007-2010), investigated the influence of innovative and sustainable school building designs on middle school education in Victoria focussing on understanding the links between design, sustainability, pedagogy and Information Communication Technology (ICT) within 21st century learning spaces.

Web site: <http://www.abp.unimelb.edu.au/research/funded/smart-green-schools/>

The projects' aims were both practical and theoretical. Practically, there was an urgent need for current and local data on school design to ensure effective spending of government funds on facilities that support learning. Theoretically, the research project aimed to advance thinking about how schools, as complex systems, engaged with contemporary design, curriculum, technological, and environmental issues.

ARC Linkage Grants are awarded on the basis of competitive peer review processes to academic research teams working with industry partners on topics of national benefit. Industry financial and in-kind contributions are supported by ARC grants.

### The project team found that the drivers of spatial change are:

- > Close relationships between designers, educators and student-users during planning and occupation
- > Educators implementing new pedagogies that require a variety of spaces (e.g. inquiry learning, problem-based learning, personalised learning plans)
- > The curriculum being planned and taught by multi-disciplinary teams of teachers who require new learning spaces
- > Ubiquitous learning, i.e. learners becoming self-directed, collaborative, resilient, learners who require a variety of spaces
- > Teachers and students who are technologically literate.

### The Consequences of Spatial and Pedagogical Change

#### Spatial:

The processes to achieve the design and occupation of new spaces are iterative rather than linear and need to be understood as occurring at the intersection of the disciplines of design and education. From conception to occupation there will be deliberation, researching, visualisation, application, testing, briefing, decision-making, creation, modelling, pricing, communication, professional development and of course, some



surprises. It is useful to attempt to map pedagogy onto spaces across time. Fit the teaching and learning experiences across a day, a week and longer into a kind of pedagogical space map; consider the range of spaces that will support all of the learning experiences to occur over time.

## Educational:

The educational vision of the school is a key document that will help in the development of an educational brief. Targeted professional development and collaboration with teaching staff are essential when learning spaces change. The role of leaders in managing the change process becomes vital. Teachers require time to imagine how things can be different. This includes assistance with developing the ability to visualise and understand spatial possibilities. Ideally, a prototype space could be used to trial furnishings, layouts and pedagogies.

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Facilitated workshops will support:

- > Interdisciplinary clusters of teachers as they plan team-teaching approaches
- > Cross-disciplinary discussions between educators and designers
- > Learning from exemplar spaces including visits to other innovative learning spaces.

1. ASMS, Flinders University, SA | Woods Bagot
2. Nth Melbourne Primary School | Mary Featherston Design
3. Nossal High School | Woods Bagot
4. 5. Canning Vale Primary School | Hassell

## Architects need to:

- > Achieve an understanding of curricula and pedagogies
- > Meet with the educator-clients frequently throughout the briefing, design and construction process
- > Insert learning technologies strategically and ubiquitously
- > Ensure there is effective post-occupancy evaluation.

## Areas identified for future research

- > Reviewing the role of furniture in facilitating a range of learning modes
- > Finding ways to support feedback loops from the classroom to policy makers
- > Ensuring there is ongoing evaluation of new spaces and learning outcomes
- > Finding ways of incorporating the surrounding landscape for formal and informal learning
- > Finding ways to better include teacher and student voice during design and occupation.

## Interdisciplinary Co-operation, Recognition, Collaboration, University and Community Benefits

### Interdisciplinary co-operation

- > The multidisciplinary team of academics and PhD students was one of the keys to the projects' success: i.e. Clare Newton (architecture), Dr Dominique Hes (sustainability), Dr Kenn Fisher (educational planning), Dr Sue Wilks (education), Prof. Kim Dovey (urban design), PhD Ben Cleveland (education), PhD Ken Woodman (architecture)
- > The project team's composition met the Victorian Curriculum standard for interdisciplinary collaboration and the University of Melbourne's preferred model of cross-disciplinary teaching. The project team collaborated with schools using action-based approaches, non-participant observation, problem-based learning, case study methodologies, exploration of big ideas and other techniques to resolve learning space issues
- > The Industry Partners contributed both financially and intellectually, providing industry knowledge. The researchers gained from partners' experience across the design, building and education sectors. Industry and government partners kept the team informed about policy updates and four meetings were held each year supplemented by newsletters.

### Recognition

- > Team members presented at academic and professional conferences, nationally and internationally including the UK Design Research Society, the Oxford Design Conference, National College for School Leadership, Chicago World Conference, Australasian and International CEFPI (Council for Educational Facilities Planners International) conferences, and the 2nd International Conference on Education, Economy and Society, Paris
- > Invited to jury membership for three CEFPI awards and the inaugural Minister's Educational Architecture Award
- > Smart Green Schools won one of Melbourne University's four 2010 Knowledge Exchange Excellence Awards. The prize money was to further knowledge



- partnership projects
- > Members won the Australian Institute of Architects 2008 Sisalation Prize.

## Collaboration

- > With the Royal Children's Hospital Education Institute - a literature review on education and learning spaces for hospitalised students
- > With iNet (International Network for Educational Transformation), three Learning Walks and seminars at our case study schools
- > On invitation, the team published two journals themed on Smart Green Schools - a special learning spaces edition of *Critical and Creative Thinking*, and *Take 8. Learning Spaces: The Transformation of Educational Spaces for the 21st Century*
- > Team members received further ARC Linkage funding for prefabricated

schools and MSSSI Interdisciplinary Seed funding

- > With colleagues from CEFPI and Swinburne, researchers conducted "Stuff It!" – a seminar for educators, facilities providers and designers focussing on furnishing learning spaces with pedagogical objectives in mind.

## University and Community Benefits

The Smart Green Schools team:

- > Gathered and made available local and international resources in the field of learning spaces and associated research
- > Assisted Ascot Vale Primary in early planning of a new multi-purpose environment
- > Assisted Williamstown High to convert an untenable space into an innovative teaching environment
- > Supported Carlton North Primary as teachers worked with Years 5 and 6 students to develop a collaborative furniture layout linked to students' maths curriculum
- > Utilised case-study buildings as learning objects. Students at Woodleigh, Thornbury, Williamstown and Dandenong schools participated in the monitoring and evaluation of their own spaces, learning about sustainability using infra-red cameras and monitors to measure heat loss, CO2, acoustics and temperatures alongside researchers
- > Conducted the Talking Spaces symposium in 2009 and Talking Spaces 2: Dissolving Barriers symposium in 2010. These events centred on opportunities for educators and designers to talk about issues of shared interest around learning spaces.

6. 7. 8. 9. Redlands Green School, Bristol



# Innovation in Learning Spaces: Ten enablers & three hurdles

**Clare Newton - Chief Investigator**

Australasia has become recognised internationally for innovative learning spaces. There is an increasing willingness to move beyond the classroom and to adopt student-centred learning approaches with teachers working as teams. In contrast, recent UK and USA schools tend to be providing traditional classroom environments behind impressive entry and communal facilities. The following points summarise observations on how innovation has been supported or hindered within the Victorian State Government case study schools that were researched over the past three years.

## Organisational enablers

**1. Flexible Briefing:** A fundamental innovation enabler occurred early in this decade when Victoria's education department loosened its architectural briefing documents. Schools and designers no longer had to provide a set number of general-purpose classrooms and could choose to develop other kinds of spaces as long as total square metres were complied with.

**2. Department Leadership:** Education departments in many Australian states have been proactive supporters of innovation bringing international experts to Australia and developing local expertise.

**3. Government Funding:** After years of funding neglect, a new state government promised education funds enabling the Victorian education department to plan a major ten-year infrastructure renewal.

**4. School Visions:** Successful innovative learning environments have been designed to respond to educational visions developed and owned by entire school communities.

**5. Collaboration:** Interdisciplinary conversations have been occurring between educators and designers increasing architects' understanding of pedagogy and teachers' understanding of space.

**6. Exemplars:** Early case studies of innovation have acted as beacons for school communities to observe and respond to.

**7. Pedagogy Innovation:** Fluid timetables with longer sessions have supported inquiry learning in a range of learning settings.

**8. Teacher Conversations:** Collaborative workspaces allow small teams of teachers to work across disciplines.

**9. Change Management:** Access to expert advice and help to support complex change-management processes. Some schools appoint a retired principal as a 'critical friend'.



10. Virginia Studio on Informal learning  
11. Lilley Centre, Brisbane | Wilson Architects  
12. 13. Westminster Academy, London, UK |  
Alford Hall Monaghan Morris Architects



**10. Attention to Detail:** Attention to the forgotten aspects of school design such as furniture selection, toilet and locker facilities and the potential for outdoor learning spaces.

## Innovation hurdles

**1. Assessment Driven Pedagogy:** Senior school learning environments remain more classroom-based than early childhood, primary and middle school environments. One reason may be that summative evaluation is still best understood as occurring within classrooms and within subject disciplines. Similarly, the national annual assessment may influence teaching modes. NAPLAN testing in Australia occurs in Years 5, 7 & 9.

**2. Blocking Points:** Many factors need to work together for innovative learning environments to succeed. Innovation can be hindered at particular points during the design to construction to occupation process. Leadership within the Department of Education and Early Childhood Development promotes innovation in school design but sometimes, overcautious risk and cost management criteria within middle management become innovation hurdles. Likewise an educational vision matched by innovative spaces needs to be matched to pedagogy.

**3. Energy Levels:** Change of any kind brings difficulties and risks. Lack of time and funds for professional development and planning works against innovation. Initial enthusiasm for change can flounder if time commitments remain high.

## Further reflections

Are we repeating the seventies? No. Different factors are influencing today's learning environments. Although the seventies' similarly focused on developing student-centred learning based on constructivist learning theory, a major difference is that today's information and computer technologies allow current students ready access to information enabling the role of the teacher to shift towards a facilitator role. Purpose designed spaces that are carefully furnished have replaced the more open plan schools

designed in the seventies. Sustainable design strategies and better acoustics are increasingly common.

## The 'Building the Education Revolution' initiative

In February 2009, the 'Building the Education Revolution' was announced as a Federal Government response to the global financial crisis. The initiative to support the economy required state governments to design and build template spaces quickly. Template spaces needed to be somewhat conservative, as users were not directly involved. The Victorian templates allowed doors to be opened into larger learning communities or closed to form classrooms.

Smart Green Schools team members have recently observed new template spaces as students and teachers first occupy them. We have watched a change from early use, where students were largely classroom-based, into more open learning environments in which the students appeared to take greater initiative for their own learning and movement. The early feedback on the new template spaces from teachers is positive.

# Environmental Monitoring

## Dominique Hes - Chief Investigator

The 'Green Team' comprising Dominique Hes and Research Assistant Pippa Howard, worked with partner schools to explore the performance of their exemplary green spaces and the extent to which teachers are engaging students in learning about these spaces through getting them involved in the data collection.

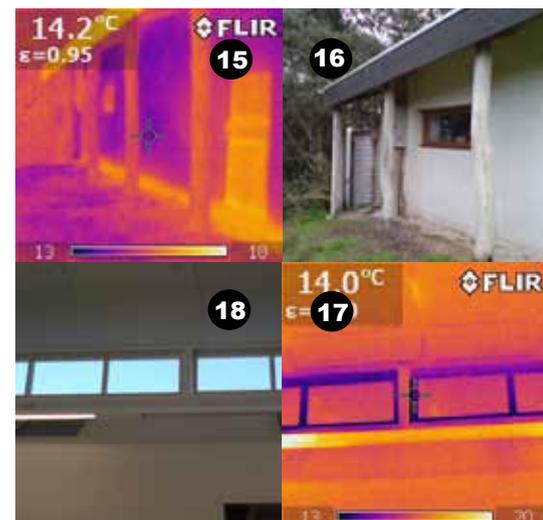
## Woodleigh School

At Woodleigh School the researchers worked with the students, conducted lessons, carried out monitoring and recorded the experiences of being involved in the development of the Environmental Sustainability Centre (ESC) which was designed and built as their own 'sustainable' building. We monitored their ESC and one of their science classrooms (S4) for comparison. The comparison between the spaces revealed that general rules of thumb, like natural light and natural ventilation, needed to be considered in relation to all other aspects such as acoustics, thermal comfort and tight envelope design. A teacher commented:

*... the thing about being in the building is that we ... can use it as a case study. We are in it! They can look up and see the louvres and understand the cross ventilation strategies. They can see and touch the eco-timber. You can talk all you like about concepts but they remain abstract until you experience them (Clarke, C., 5.10.2009).*



- 14. Woodleigh School with goat
- 15. 16. Thermal image showing heat bleeding out through the ground
- 17. 18. Roof level windows showing cold coming in through windows
- 19. Thornbury High School General Purpose Classrooms | Luke Middleton Designer Photographer: Scott Haskins
- 20. 21. Thermal image of heat leaking out of poorly sealed edges
- 22. 23. Thermal image of heat transfer through metal ceiling frame. The roof above is clear
- 24. 25. Thermal image of children's hands & the residual heat left from them
- 26. 27. Light levels, colour, absorbance and reflectivity workshops at Thornbury High



## Thornbury High School

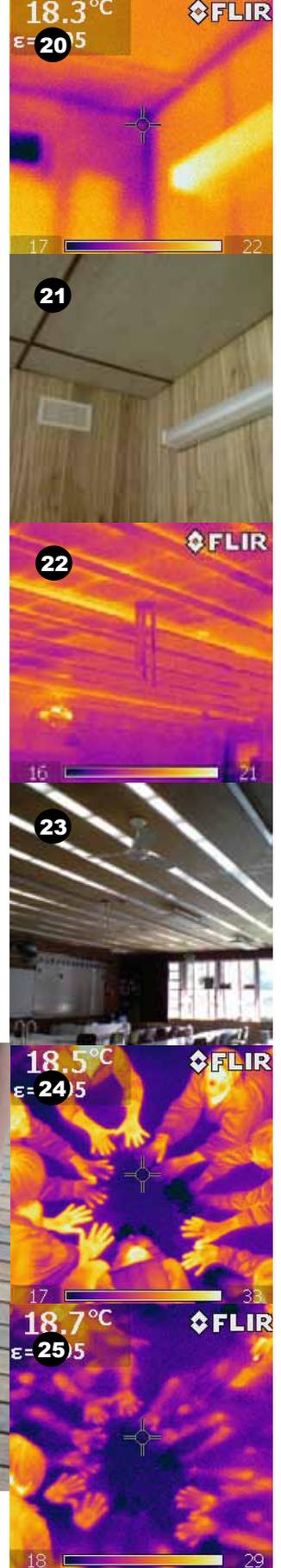
At Thornbury High School we introduced the monitoring equipment to the students in innovative ways related to their drama performances. They 'played' with the equipment and could then understand the outputs of the monitoring – such as the thermal images below and to the right. The recording studio and general purpose classroom at Thornbury were designed by Luke Middleton.

### Lessons from the 'green' team

Although we still have eight months of monitoring and working with the schools to go, we have already found several themes. Many projects are trying to optimize one aspect without considering the impact on others:

- > Exposed thermal mass and cross ventilation will affect acoustics
- > Using thermal mass for stabilization of internal temperature is effective but thermal bridging and insulation needs to also be addressed
- > Natural light will affect thermal load
- > A relationship between the building and its users is crucial for any building to perform to its optimum potential.

In connection with the last point, the main finding to date is that it is crucial for the efficient running of a building, that time is spent on building a relationship with the building itself.



## Making the most of the investment in infrastructure – using buildings as text books and laboratories

To build the relationship between users and the building, schools need to develop an understanding of the building, and for this they need the appropriate language. Anne Taylor (2009) calls this the 'knowing eye'. It is the development of this with the teachers and students that the 'green team' is most excited about. The researchers wanted to engage teachers and students in collecting the performance data and have found in trying to achieve this that the students needed to understand the equipment. Through trying to teach them this we monitored the building. The outcomes were that the students understood some of the elements of building design – light, materials, acoustics and heat transfer. It is too early to discern if having this experience has had any impact on their ability to understand their building, but some anecdotal feedback from their teachers suggests that this is a very effective and engaging approach to learning - learning described by others as authentic, real world and immediate.



...it is crucial for the efficient running of a building, that time is spent on building a relationship with the building

28. 29. Woodleigh School ESC  
30. Woodleigh School section diagram |  
Luke Middleton Designer



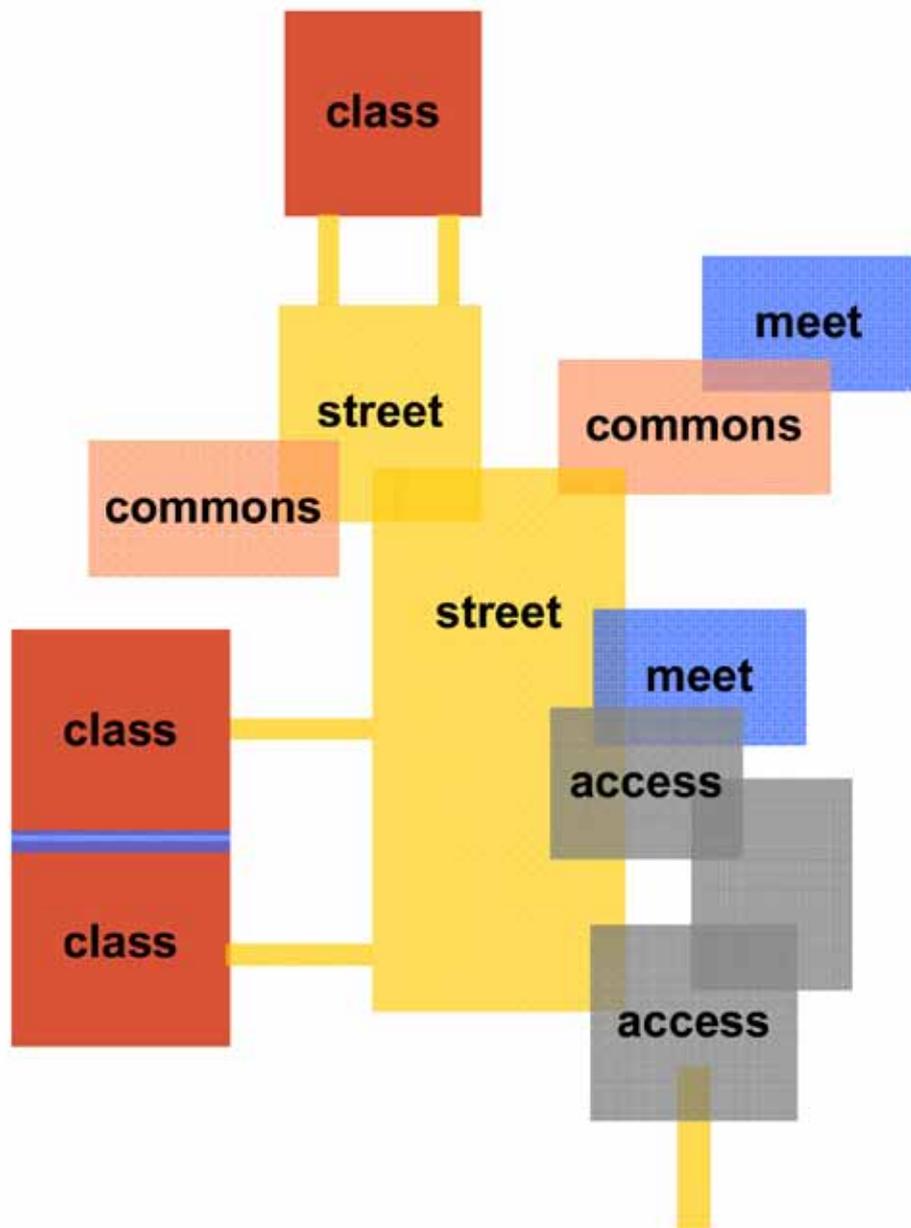
# Plans & Pedagogies

**Kim Dovey, Chief Investigator**

**Kenn Fisher, Partner Investigator**

This is a research project in process that explores the relationships between new pedagogies and the spatial structures and plan types of middle schools.

The architecture that has emerged in response to the demand for flexibility and dynamism involves a very broad range of plan types but also certain patterns of spatial structure and spatial segmentarity designed to enable new forms of teaching and learning. A range of new and award winning school plans are analysed as socio-spatial assemblages to produce generic diagrams with spatial types such as traditional classrooms, learning commons, learning streets, meeting areas and outdoors. We are particularly interested in how these spaces link and interpenetrate, and how they enable and constrain different pedagogical practices and group sizes. Emerging building types are often hybrid in the sense that they enable both new pedagogies and capacities for reversibility to traditional classroom practices. The work will also involve a theoretical critique of the ways school plans embody a broader shift from Foucaultian institutions of disciplinary power to a more Deleuzian conception of complex adaptive assemblages.



...the ways school plans embody a broader shift from Foucaultian institutions of disciplinary power to a more Deleuzian conception of complex adaptive assemblages

# The Evaluation of 21stC Learning Environments

## Kenn Fisher - Partner Investigator

In this section a pedagogically framed evaluation tool called the Learning Environments Evaluation Tool (LEET) developed by Rubida Research is outlined followed by brief descriptions of some extant evaluation models.

LEET is framed around key elements of the Victorian Department for Education and Early Childhood Development's (DEECD) Principles of Teaching and Learning (POLT); the Victorian Essential Learning Standards (VELS); and the e5 instructional model for teacher engagement levels in various continuing professional development categories.

The tool is structured as in the diagram below:

Framework for LEET

	Typical Questions	Well Being	Student Engagement & Support	Learning for Life	Global Impact
<b>Phase 1</b> Pre-design information gathering and evaluation of existing facilities	What is effective? What is important?	<ul style="list-style-type: none"> <li>Space, movement &amp; circulation</li> <li>Health &amp; safety</li> <li>Visibility &amp; supervision</li> <li>Amenities</li> </ul>	<ul style="list-style-type: none"> <li>Belonging</li> <li>Pastoral Care</li> <li>Stage-related spaces</li> <li>Resources</li> <li>Validation</li> <li>Resonance</li> <li>Involvement</li> <li>Transition</li> <li>Staff Support</li> <li>Professional Learning</li> </ul>	<ul style="list-style-type: none"> <li>Independence</li> <li>Reflection</li> <li>Self-direction</li> <li>Collaboration</li> <li>Communication</li> <li>Creativity</li> <li>Imagination</li> <li>Exploration</li> <li>Authenticity</li> <li>Personalisation</li> <li>Information and communication technology</li> </ul>	<ul style="list-style-type: none"> <li>Outdoor links</li> <li>Environmentally sustainable design</li> <li>Community involvement</li> <li>Social and ethical objectives</li> </ul>
<b>Phase 2</b> Information gathering & discussion facilitation during the three stages of design	How will it be used? How will it work?	<ul style="list-style-type: none"> <li>Light</li> <li>Temperature &amp; air flow</li> <li>Acoustics</li> <li>Aesthetics</li> <li>Professional Learning</li> </ul>			
<b>Phase 3</b> Post-occupancy evaluation of the learning environment & its impact on pedagogical activity	Is it successful? Is it sufficient?				

DEECDs professional development strategy:

- 1 Engage with examples of teacher practice
- 2 Explore the e5 model, links to VELS, POLT and principles of effective Professional Development (PD)
- 3 Explain the lessons learnt through the action research
- 4 Elaborate how to extend and adapt the model in the context of "Instructional Leadership"
- 5 Evaluate the e5 model and the PD program related to it.

## Other existing evaluation models

- > **Fielding Nair EFEI** – the Educational Facilities Evaluation Instrument is based around a range of learning modalities. Spaces including classrooms/ learning studios/ small learning communities are scored for attributes such as student display space; home base and individual storage; areas for hands-on experimentation; arts studios; life skills areas; connections to community.
- > **CABE – The Commission for Architecture and the Built Environment, UK** <<http://www.cabe.org.uk/publications/assessing-secondary-school-design-quality>> has been involved in assessing school design quality since 2005 and has recently distilled these criteria to 10 key factors that are used by the UK Counties' Building Schools for the Future programs as part of the approvals/evaluation process.
- > **New Zealand Ministry of Education** – carried out a qualitative survey of the opinions of architects, parents, teachers, principals and school boards to determine the impact of the physical environment on learning outcomes.
- > **Quality Indicators in the Design of Schools** (QIDS, Royal Institute of Architects, Scotland) evaluates eight key criteria: Uses and Spaces, Character and Form, Access,

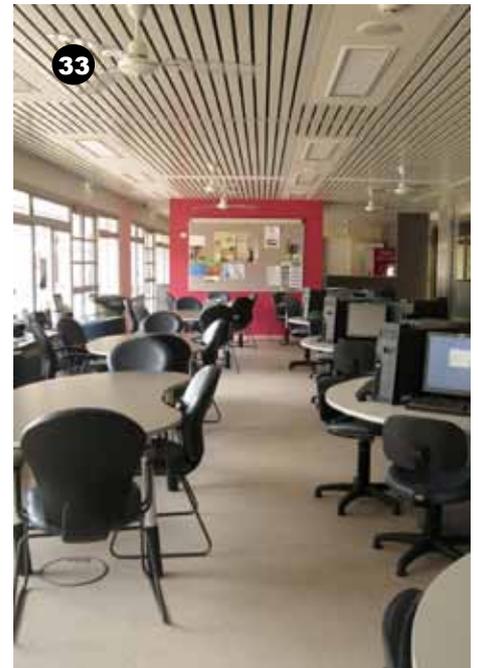
Internal Environment, External Environment, Social Integration, Sustainability and Ecology, Engineered Systems and Performance, and Construction. The approach also considers the time factor in that these evaluations can be checked using the spider tool over different time intervals, to determine improvements over time and to equalise these where possible.

- > **Sanoff's** multi-faceted approach begins with a School Building Observation Form that assesses 13 criteria around personal perceptions of School Order, Maintenance, Attractiveness and related issues such as Context, Massing, Interface, Wayfinding, Social Spaces, and Comfort. These are supported by a Photographic Rating Scale, Classroom Environmental Ratings, a Classroom Arrangement Rating Scale, an Indoor Learning Space Rating Scale, an Outdoor Rating Scale, and finally a Space Assessment Worksheet that examines Spatial Layouts, Physical Attributes, Seating Arrangements and Furniture. Despite all these measurement scales, pedagogical and curriculum support are not being measured.
- > **Evaluation of the Quality of Educational Spaces** (OECD Centre for Effective Learning Environments - CELE) is a pilot project involving seven member countries. Pilot projects are being carried out in these countries using the tool developed with the advice of the CELE International Panel of Experts (Kenn Fisher is a member).

## Next Steps

There is little evidence that these models are measuring the effect of the learning environment on pedagogical, curriculum and/or learning outcomes. A research project has been initiated that will continue to build on the strategies of these four approaches. The project has been designed to triangulate the findings from each approach to validate the effectiveness of the learning environment assessment tool currently under development.

- 31. North Melbourne Primary School | Mary Featherston Design
- 32. University of Queensland, Engineering | Wilson Architects
- 33. Mindarie Secondary College, Perth | Donaldson + Warn Architects



# Making the Spatial Visible

## Sue Wilks - Partner Investigator

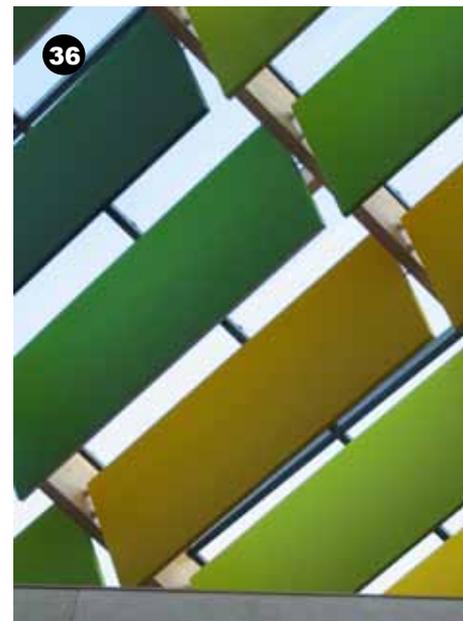
Following extensive observation and interviews over the three years of our project, I am convinced that a number of factors are vital for the effective transition into new learning spaces. They include: teacher and student involvement at the planning stages, the provision of clear visual representation of emergent new spaces, assisting teachers to 'read' visual representations of the learning spaces they are about to occupy and allotting time for teachers to spend with designers exchanging professional language (jargon, acronyms etc) and cultural understandings. I believe teachers require assistance to become more spatially and technologically literate, and if possible, time to practice using the new pedagogical approaches in various 'facsimile' configurations of proposed learning space designs.

The provision of new learning spaces is currently creating an urgent need for training and for experienced educators to become skilful users or even co-designers of new learning environments. This has previously not been part of their professional world. As well as taking on a role in the planning stages of new buildings, teachers will need to regularly reconfigure physical spaces to suit their teaching requirements. For many, the availability of new learning technology resources will mean upgrading their computer soft- and hard-ware knowledge. New spaces enabling new pedagogies will combine to form environments in which students are able to collaborate, problem-solve and create – all aspects of the newly emergent pedagogical modes.

In the case of building and occupying schools, the professions of designer and educator need to work together to develop and test new ways of understanding each other's culture and preferred ways of communicating, presenting and receiving information.

Designers could use their visual skills to convert and communicate architectural information by using simple and direct visual vocabulary. On the other hand, educators could apply their methods and theories to test the validity and impact of the new pedagogies and spaces in terms of learning, information, and use-ability. Simple line drawings well executed by both professions can often explain complexities better than the spoken or written word.

One of the difficulties associated with communication about, and understanding of, space is that most lay people have to "be in it" to perceive it. Educators generally have not had their attention drawn to the scale of classrooms, the internal surfaces, furnishings, textures, the illumination or colours of their existing teaching spaces. Other factors affecting spatial awareness to a greater or lesser extent, depending on the individual, are



Architects working with teachers have found that few can express ideal spaces using anything other than the spaces, furnishings and equipment they already have

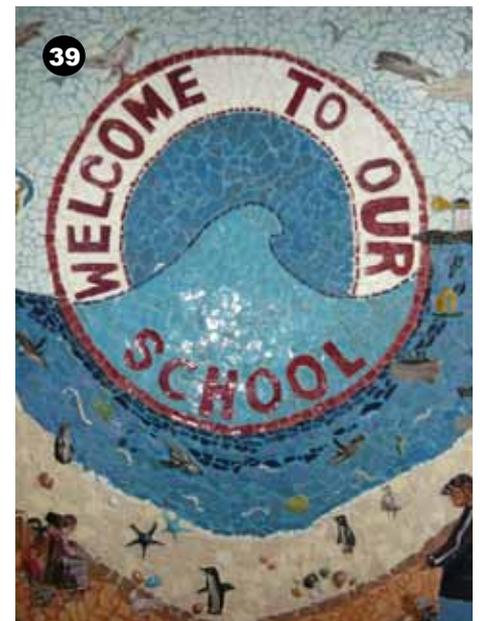
perceptual awareness of sounds (echoes etc), odours, feel, movement (constricted or easy) and the difference made by spending different lengths of time in a space and with a variety of classes and colleagues.

Given opportunities to experience and reflect on spaces and their preferred teaching modes, individual teachers should be able to make judgments about whether certain spaces are suitable. But, to do this, they must be able to 'read' proposed spaces. Architects working with teachers have found that few can express ideal spaces using anything other than the spaces, furnishings and equipment they already have. They need exposure to new versions of all three.

LEVROS (Learning Environments Virtual Reality Online Simulator) offers the opportunity to use virtual environments and experience the benefits of and/or resolve any problems with learning spaces before construction starts. It is a sophisticated fully interactive 3D environment that can be explored using online characters (avatars – man, woman, boy, girl and wheelchair users) and a simple user interface. It was jointly developed by staff from the Institute of Education, University of London, Birmingham Local Education Partnership and educational planner, Kenn Fisher (Partner, Smart Green Schools project). See <<http://blog.archi-me.com/?tag=levros>>.

Teachers and students anywhere in the world can work together to experiment with furniture, resources and layout, moving them freely to modify environments. With the ability to manipulate objects and positioning, it will be a powerful way of testing the effectiveness of learning environments for all students and provides a model for learning that brings real and virtual worlds together.

34. Fawood Children's Centre, London, UK | Alsop Architects
35. Mindarie Senior College, Perth | Donaldson + Warn Architects
36. Westminster Academy, London, UK | Alford Hall Monaghan Morris Architects
37. Newstead College, Tasmania | Glenn Smith Associates/Forward Viney Woollan
38. Furniture, Woorana Primary School | Mary Featherston Design
39. Special Ed, NW Burnie Campus, Tasmania



# THE POSTGRADUATE STUDENTS

Two PhD scholarships were funded as part of the Smart Green Schools ARC Linkage Grant and were awarded on a competitive basis to a teacher, Ben Cleveland and an architect, Ken Woodman. Both are currently nearing completion of the writing-up of their research.

## The Role of Space in Creating New Socio-spatial Contexts for Learning

**Ben Cleveland**, a teacher undertaking his PhD with Smart Green Schools has investigated the following:

- > Ways middle school (Years 5-9) learning environments can be designed and used to support constructivist pedagogies and improve student engagement in learning
- > The revolution of educational practice and the design of physical learning environments in three case study schools in Victoria
- > The impacts that space and the use of space have on socio-pedagogical culture.

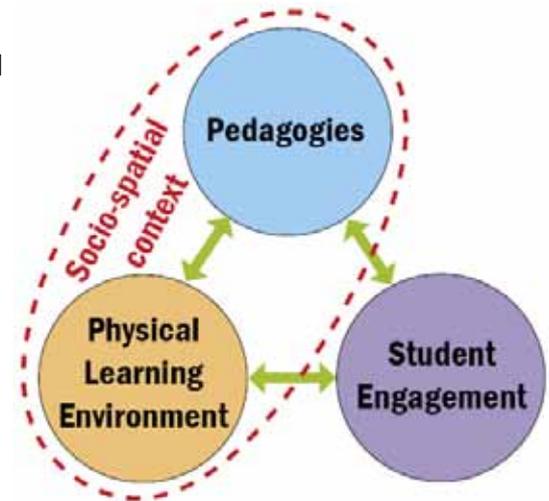
### Some of Ben's findings:

#### The co-evolution of space and practice

- > A clear vision for education is an essential ingredient in a school design project
- > Good design is based on deep understandings of desired educational practices
- > The learning environment may be thought of as a construct of three parts: physical, virtual and social. Good school design requires each of these components to be carefully considered within the overall context of the learning environment
- > Contemporary school design supports a flow of activity. Interconnected learning settings enable students and teachers to move between spaces to access physical and virtual resources including books, computers, and hands-on materials.

#### Space as a catalyst for cultural and social change

- > For new education models to be successful, the alignment of practice and space is essential. For this to occur, significant contributions from school communities (principals, teachers, students, parents) and designers (architects, interior designers, landscape architects) are required
- > Curriculum, pedagogy and assessment all need to adapt when stepping out of the 'box'
- > New practice/behavioural frameworks that explicitly address how to use



innovative spaces need to be developed by schools. Such frameworks should identify the roles that both teachers and students play.

#### The role of space in new education models

- > Well-considered interior design can support a school's desired educational practices
- > The ubiquitous integration of wireless internet enabled technologies can support the personalisation of learning.

40. 42. Glamorgan Primary School | Mary Featherston Design

41. Mckinnon Primary School | Kneeler Design Architects

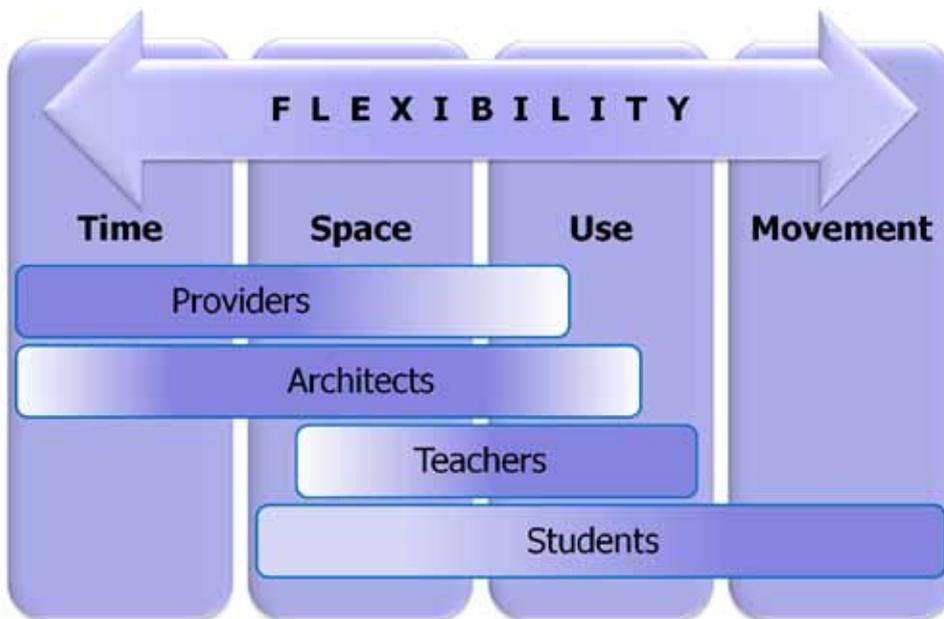
...the school community has sought to create more democratic, dynamic and creative environments to support collaborative as well as individual learning



# Flexibility in Learning Spaces and Learning

**Ken Woodman**, an architect undertaking his PhD with Smart Green Schools has investigated the phenomenon of flexibility in learning spaces and learning. The educational theory literature suggests that social constructivist learning is supported by the student's environmental situation and that periodic physical movement by the student is important for learning. Architectural theory literature discusses space as a social construct, a multiplicity of trajectories with place as an assemblage held together by desires. So, to what extent is the manipulation of learning spaces and the movement of students affecting learning attitudes and how can these actions create a place assemblage that can support learning?

In his field research, Ken undertook interviews with students, teachers, architects and facilities providers and found that there was a mismatch between their understandings of the term flexibility. He broke the term flexibility down into four categories of time, space, use and movement. Time related to the adapting of buildings to new uses over time; space related to the transformation of architectural space or furniture to satisfy different needs; use related to the polyvalence of a space to be put to different uses without undergoing change itself; and movement related to the fluid and free movement of teachers and students to support their learning. Using these categories the interviewee's understandings were graphically described as follows:



The understandings were spread over several categories, but the facilities providers predominately thought of flexibility in terms of time, the architects mainly of space, the teachers principally of use, and the students were virtually alone in thinking about flexibility in terms of movement.

Ken worked in a case study secondary school in regional Victoria. He mapped six different learning spaces from traditional classrooms through a double team teaching portable to a purpose-designed flexible senior centre. There was a range of teacher-centred, student-centred and balanced pedagogy with age groups from Years 7 to 11.

Mapping consisted of recording changes in space and furniture, changes in the use of the space, and tracking the movement of one teacher and a male and female student over a school session of 100 minutes every month for six months. This revealed that during teacher-centred learning the students remained static in their learning spaces despite the educational and social desire and physiological need to move to enhance learning.

However, Ken found that student-centred learning results in student movement. Two examples of the movement mapping are shown right with the magenta lines reflecting the teacher movement, the red a female student and the blue a male student. A circle represents the length of time an individual remains static in one location with the larger the circle the longer in one location.

Finally, Ken worked with a group of Year 9 students in a participatory action research process to manipulate their learning space. Together they changed traditional learning spaces into flexible learning spaces that provided a range of purposeful learning settings.



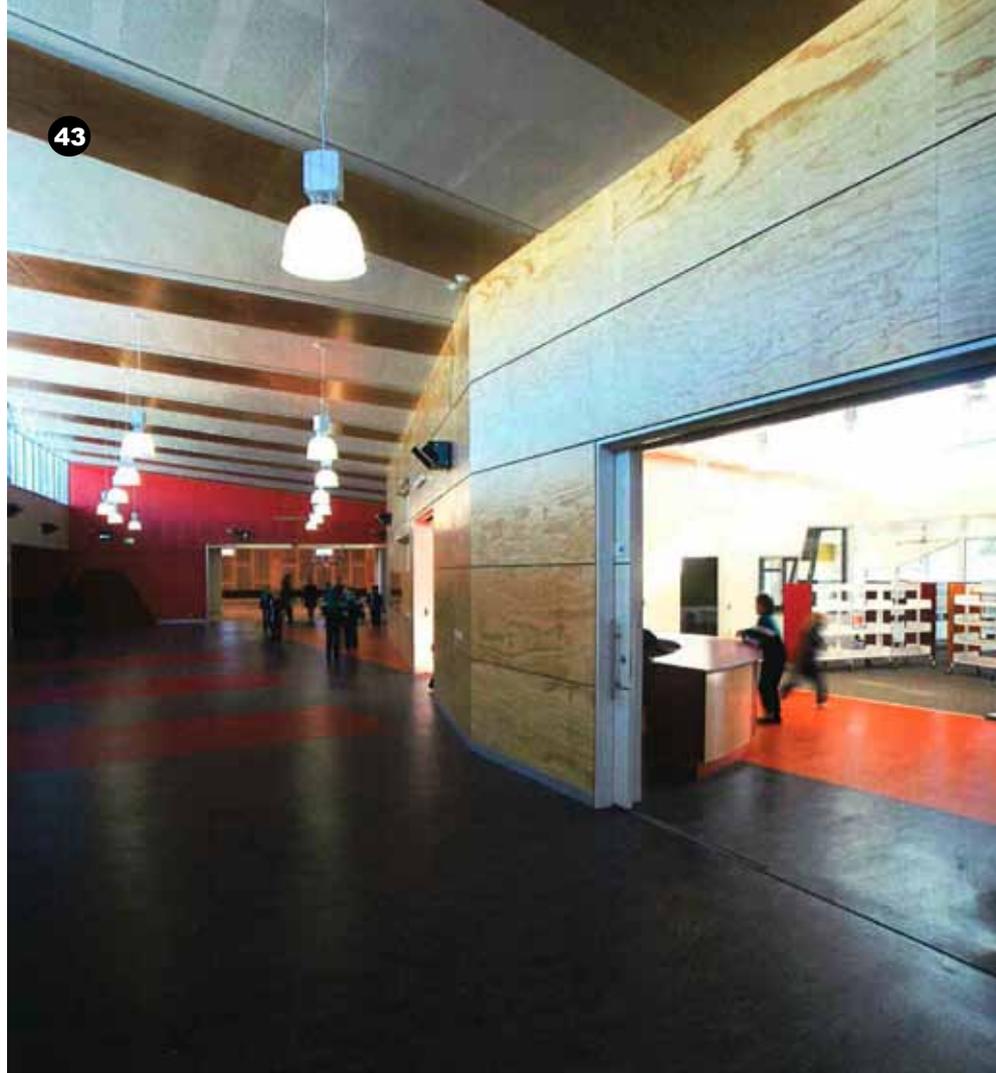
A] Teacher-centred Learning



B] Student-centred Learning

It was established that through such manipulation the students gained ownership over their learning space. However, more importantly, the control for the learning space moved from the teachers to the students. This feeling of ownership and control extended to their learning and, as such, improved their perception of their learning capabilities. Thus, flexibility has the potential to create student learning places as an assemblage held together by the students through the desire to improve their learning.

43. Yuille Park P-8 Community College | Prior Cheney Architects  
 44. Lilley Centre, Brisbane | Wilson Architects



## Recent Education Awards

### 2010

CEFPI (Australasian Region) Best New School/Major Facility: Dandenong High School

### 2009

DEECD School Design Awards Best Overall Project: Dandenong High School  
DEECD School Design Awards Best Secondary School: Dandenong High School  
CEFPI (Victoria Chapter) Winner New Construction/Major Facility: Dandenong High School

### 2008

CEFPI (International) Best New School/Facility Construction: Camberwell Girls Grammar School  
CEFPI (Australasia Chapter) Best New School/Facility Construction: Camberwell Girls Grammar School  
CEFPI (Victorian Chapter) Best New School/Facility Construction: Camberwell Girls Grammar School

### 2006

DEECD School Design Awards Best School/Overall winner from all categories: Wallan Secondary College  
DEECD School Design Awards, Best Secondary School/New or Redeveloped: Wallan Secondary College



## THE INDUSTRY PARTNERS

*The Smart Green Schools team appreciates the contribution of the industry partners to the research project, as well as the many teachers and students who helped inform our team members by responding in interviews and being willing participants within our research.*

## Hayball's Smart Green Schools

### Richard Leonard

*Richard Leonard leads a team of architects, interior designers and urban designers working on 21st century learning spaces. As Director of Hayball, Richard contributed financial and in-kind support to the Smart Green Schools research and was actively involved giving timely advice at workshops and partner meetings as well as access to industry expertise. The team appreciates the significant contribution of Hayball to the research process. Some of Hayball's successes in the educational sector are described to the right.*

### Recognised Achievement

The Discovery Centre at Camberwell Girls Grammar School was awarded 2008 CEFPI (International) Best New School and Dandenong High School picked up the same prize at the 2009/10 CEFPI Awards. Both these and many other Hayball projects have received global media coverage and effectively communicated the values of the schools in question to a local and international audience.

### Leaders in Education Design

Hayball is an acknowledged leader in education architecture. Richard Leonard is a member and current president of the Victorian Branch of CEFPI, an Honorary Fellow at the University of Melbourne and an active speaker at conferences and seminars associated with the field.

### Environmental Sustainability

Hayball have been exploring Environmentally Sustainable Design for many years. Supported by the in-house Green Team and Hayball Research, project teams work to address a complex matrix of environmental objectives that extend far beyond energy use and water recycling. Effective environmental design at both micro and macro levels, is crucial in mitigating the current crises of land use, climate change and resource consumption.

45. Camberwell Girls' Grammar School | Hayball  
46. Dandenong High School | Hayball

# Education Projects

## Wallan Secondary College

*An award-winning State secondary college in a city fringe location*

Location: Wallan, Victoria

Services: Architecture and Interior Design

Client: DEECD

The development of the school's design benefited from extensive community consultation and Shire input.

The design grew from environmental design strategies, employing a host of passive design methods that have proven effective including solar orientation, operable ventilation systems, thermal mass, an ecologically appropriate material palette, and energy efficient lighting. The planning is characterised by 'loose-fit', flexible settings that cater to current education pedagogies.

## Camberwell Girls' Grammar

*Ten classrooms, Discovery Room, common areas, staff and administration together with an Early Learning Centre*

Location: Camberwell, Melbourne

Services: Architecture, Interior Design and Masterplanning

The brief and planning strategy was developed to provide a logical transition for junior students – from the Early Learning Centre to later years of primary education.

The buildings have been designed to fit sensitively within the heavily treed site. This facility provides a prominent landmark for the local community, a focus for junior education and a significant branding opportunity for Camberwell Girls Grammar.

## Dandenong High School

*The amalgamation of three existing schools and over 2000 students*

Location: Dandenong, Victoria

Services: Architecture, Interior Design and Urban Design

Client: DEECD

The design tackles the dilemma of the 'large' school by organising students within seven discrete SWIS (School Within a School) buildings.

The project provides the case study for the AGBR 'GreenStar' education pilot. Key ESD initiatives include air tempering, water re-use, improved natural lighting, environmentally preferable materials, building waste management and display of building performance to aid ongoing research.





47



48

47. 49. 50. 52. Wooranna Resource Centre  
 48. Wooranna Prep. Grade | 51. Dandenong High School  
 53. Monash University, Frankston, Early Learning Centre  
 54. Geelong Grammar School, Toorak



49



51



50

# Design of Environments that Support Contemporary Learning and Teaching

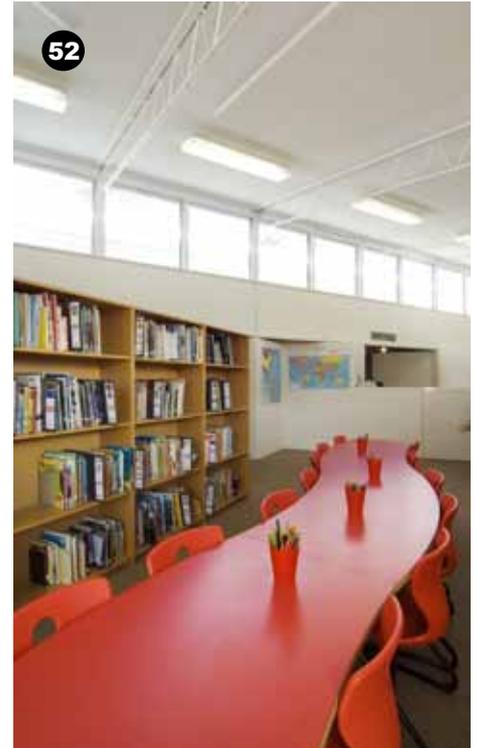
## Mary Featherston

*The Smart Green Schools team appreciates the contribution of Mary Featherston to the research project during partner meetings and seminars as well as bringing connections to other research projects and working with the postgraduate students.*

Since 1998 Mary Featherston has focussed on design of environments that support contemporary learning and teaching. These projects have included new and re-furnished environments in public and private schools for all age levels. In each case the school community has sought to create more democratic, dynamic and creative environments to support collaborative as well as individual learning. The schools are characterised by a whole school vision based on the development of democratic and close personal relationships and rich, transdisciplinary long-term inquiry projects. All forms of learning from directed to experiential, both in real and virtual realms, are equally valued and supported.

In each project, space has been configured to create Neighbourhoods for a particular community of learners. Each Neighbourhood or home base is an assemblage of diverse, discrete settings all interlinked to create fluid spaces. These environments are relatively permanent rather than totally flexible.

Design of the physical environment, though vital to the process of transforming pedagogy, is seen as only one element of change along with re-conceptualising all aspects of organisation: grouping of students and teachers, curriculum content and time management. The experience and commitment of the educators involved in these projects has enabled an ongoing process of research, linking theory and practice in education and design to better understand the new and complex requirements of young people and contemporary pedagogy.





## Environmentally Sustainable Design

### Department of Education & Early Childhood Development (DEECD)

*DEECD was the key linkage partner for the Smart Green Schools research contributing substantial financial and in-kind support. The research would not have been possible without the support of Dr Peter Stewart, Manager of the Infrastructure Division. The Smart Green Schools team also thanks the contribution of other DEECD colleagues.*

Victorian government schools are leading the way in sustainability. Healthy buildings create healthy learning spaces, stimulate students and lead to improved learning outcomes. Victoria has good access to wind and solar energy, making schools great settings for renewable energy projects. Low rainfall and water restrictions have affected many schools. Victoria's new school designs reduce the demand for mains water. Smart material selection greatly reduces the environmental impact of a school. Through extensive environmentally sustainable design analysis and computer modelling, the new school designs enhance environmental performance and minimise running costs.

### Building Management System

This is a computer-controlled environmental measurement and controls system that measures temperature and water, gas, electricity and light usage. The weather station – an LCD screen located in each building – displays these measurements. The system also controls natural ventilation louvres, sensing carbon dioxide levels when the building is in use and allowing the building to cool overnight.

### Passive Design

Passive design applies simple techniques to help improve environmental performance. It includes orientation, natural light, shading and enhanced thermal performance. Passive design techniques in new Victorian schools include:

- > increased roof and wall insulation in excess of regulatory standards
- > high performance glazing and a range of shading methods
- > natural cross-ventilation

### Heating and Cooling

Victoria's new school buildings use the most efficient gas-fired heating systems to maximise thermal performance and minimise environmental impact. The selected cooling systems provide the lowest environmental impact by using devices to suit various site conditions and orientations.

## Water Savings

Conserving water is an important element in school design. Each new building includes rain water collection tanks to harvest water for use in the toilets. Water usage is also measured and displayed in the building management system supplied with each building.

## Low Energy Lighting

Energy-efficient light fittings and fluorescent lamps are a standard feature of school design. The lighting system is augmented by daylight sensors on perimeter zones and motion detectors that dim or turn off lights when ambient light levels are high or the areas are vacant for extended periods of time. Light usage is measured and displayed by the building management system.

## Ventilation

Ventilation in internal school environments affects student alertness and concentration. Ventilation dilutes odours and limits the concentration of carbon dioxide and airborne pollutants. Victoria's new school designs incorporate a variety of ventilation systems, such as louvres (manually and automatically operated) and high level extraction and ceiling fans. Each building contains two sensors linked to the building management system to monitor stale air levels and to automate ventilation when required.

- 55. Dandenong High School | Hayball
- 56. Air sock used for draught-free air distribution and delivery of conditioned air
- 57. Gabion substructure to seating
- 58. Barwon Heads Primary School | MGS





## SBE Sustainable Built Environments

### Sean McArdle

*The Smart Green Schools team appreciates the contribution of Sean McArdle and his multi-disciplined team to the research, particularly during partner meetings. The notes below are adapted from the SBE website: <http://www.sbe.com.au/home.html>*

The ultimate aim in environmental design for the built environment is to create buildings that use no energy, no water, produce no waste in operation or construction, and are made of materials that are derived from fully sustainable sources. Whilst this is very difficult to achieve in practice, this aim should act as a theoretical lighthouse for opportunities that should be considered in any project.

Good design is essential for a sustainable, inclusive, healthy and beautiful environment that is accessible to everyone

## The Office of the Victorian Government Architect

### Jenni Calzini

*The Office of the Victorian Government Architect partnered the Smart Green Schools ARC Linkage research with Jenni Calzini as the key contact. The Smart Green Schools team appreciates the commitment of substantial financial and in-kind support to the research from John Denton, as Government Architect and Shelley Penn, as Associate Government Architect. Without such support from industry, research of this scale would not be possible. The notes below are adapted from its website: <http://www.dpc.vic.gov.au>*

The Office sees partnerships as supporting their own role of providing leadership and strategic advice to Government about architecture and urban design.

Victoria has a global reputation for design excellence in the built environment, and this is extended and enriched through the Government's support of high quality design outcomes. Good design is essential for a sustainable, inclusive, healthy and beautiful environment that is accessible to everyone. The Office aims to encourage high quality buildings and public spaces that: are engaging, inclusive and diverse; are environmentally, economically and socially sustainable; promote confidence and well-being in the community; and are culturally rich.

## McGauran Giannini Soon

### Rob McGauran & Eli Giannini

*The Smart Green Schools team appreciates the contribution of Rob McGauran and Eli Giannini and other MGS staff to the research, particularly during partner meetings. As well as this in-kind support, the Smart Green Schools team appreciates the case contribution made to the research by MGS Architects. The notes below are adapted from their website: [www.mgsarchitects.com.au/](http://www.mgsarchitects.com.au/)*

The range of experience of the practice includes institutional and educational buildings such as:

### Boroondara Park Primary School

Through open communication and responding to needs and concerns of the school community, MGS's strategic approach to the design of the new facility was driven by the desire to maximize their potential to support the educational framework and methodologies of the school. The new additions provided clear linkages with existing buildings and outdoor spaces.

### Barwon Heads Primary School

Key issues addressed in this project included the development of an environmental approach to design and promotion of the school's role in the wider community. The integrated circulation route connected the new classrooms and created a central, sheltered, landscaped courtyard that acted as a focus for the school community.



## McBride Charles Ryan

### Debbie-Lyn Ryan

*The Smart Green Schools team appreciates the contribution of Debbie-Lyn Ryan and Rob McBride and other MCR staff to the research, particularly during partner meetings. The notes below are adapted from their website: [www.mcbridecharlesryan.com.au/](http://www.mcbridecharlesryan.com.au/)*

MCR works closely with school communities responding to their pedagogical insights and experiences and unique cultural mixes. For example:

The Fitzroy High School community had developed a curriculum structured around the arts. MCR's three story addition provided four large studio spaces that were carefully shaped to accommodate a variety of learning modalities from open style lecture to small gatherings. The school hosted three site visits for the Smart Green Schools project that led to fruitful discussions about effective learning spaces amongst educators and designers.

### In development

The Dallas-Upfield Primary School facility is a combination of two existing school communities and an exploration of how new pedagogy methods may be reflected in various configurations of age-appropriate learning spaces. The design aims to construct an atmosphere that facilitates a fluid journey through shared interior and courtyard spaces.

59. Fitzroy High | McBride Charles Ryan  
60. Barwon Heads Primary School | MGS

## The Melbourne University Research Team

Clare Newton, with a background in the teaching and practice of architectural construction and design, negotiated collaboration between the design professionals and teachers.

Dr Dominique Hes, focused on the environmental outcomes and developed and installed monitoring strategies (for the student cohorts).

Professor Kim Dovey's background in social critique of space and discourse analysis supported a social research framework to complement the environmental, functional and educational evaluations.

Dr Kenn Fisher (Rubida Research) recognised internationally for his leading educational facility specialist expertise with experience in both school and university sectors assisted the focus on the collaboration between the design professions, students and teachers.

Dr Sue Wilks' background in education and curriculum design supported the research interventions. Her focus, as research associate, was on the use of buildings as 3D textbooks in curricula and professional development models.

Ben Cleveland - secondary school teacher - undertook his PhD from his disciplinary perspective exploring learning spaces and student engagement.

Ken Woodman - architect - undertook his PhD from his disciplinary perspective exploring the meaning of flexibility.

61. Westminster Academy, London, UK | Alford  
Hall Monaghan Morris Architects  
62. Thermal image of Woodleigh goat & chickens.  
Ask Dominique or Pippa about the goat

## Industry Partners Steering Committee

Dr Peter Stewart is General Manager, School Resources Division of the Victorian Department of Education and Early Childhood Development. Its Building Futures Policy puts improved educational outcomes for students at the core of all its decisions.

Jenni Calzini, The Victorian Government Architect's Office is interested in the provision of good quality and sustainable buildings that support modern teaching and learning.

Mary Featherston specialises in the design of innovative learning environments and the relationship between pedagogy and design.

H2o architects has a reputation for the successful delivery of progressive and sustainable projects in the educational environment.

Rob McGauran and Eli Giannini of McGauran Giannini Soon have been involved in the design of primary and secondary schools as sustainable communities.

Richard Leonard, Hayball, experienced in the development of innovative education projects from primary to tertiary levels.

Sean McArdle, SBE Melbourne, with an integrated multi-disciplined team, has worked with the DEECD on new design guidelines for schools.





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