

Evaluating the pedagogical effectiveness of learning spaces

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Abstract: This paper describes the development and ongoing use of the School Spaces Evaluation Instrument (SSEI): an evaluation tool developed to gather information about how effectively school architecture supports teaching and learning. In 2009, the Australian Federal Government pledged \$16.2 billion towards the Building the Education Revolution (BER). Over the following three years learning spaces were built or refurbished in 9,526 schools nationwide. In Victoria, Catholic Education Melbourne (CEM) encouraged schools to work with architects to design bespoke solutions. This process led to the design and construction of hundreds of new learning spaces, each with different spatial arrangements. Approximately five years on, questions remain about which architectural solutions worked best. To help answer these questions, and inform decisions about how capital budgets should be spent in the future, the Learning Environments Applied Research Network (LEARN) and CEM collaborated to develop the SSEI tool, including Module 3 – Alignment of Pedagogy and Learning Environments. This tool will be used over the coming three years to evaluate school facilities in the Catholic education sector for the purpose of generating new knowledge about how best to design and use school facilities for contemporary teaching and learning.

Keywords: School architecture; learning spaces; evaluation; pedagogy.

1. Introduction

Do our existing and newly built school facilities meet the needs of today's teachers and learners – not to mention their future needs? While many architects and educators hold strong views about how schools should be designed for contemporary education, there remains little substantive evidence on the impact of different architectures (spatial arrangements, interior design, furniture selection) on the behaviours and performance characteristics of students and teachers.

In the state of Victoria, Australia, it is no longer an assumption that schools will be composed of a suite of discrete classrooms and specialist spaces for subjects like art and science. Over the past decade a range of 'innovative spaces' have been developed by the Catholic, state and private education sectors. As the trend towards creating resource and technology rich facilities (Monahan, 2005; JISC, 2006; Dudek, 2008) is expensive, it is vital to ascertain 'what works' and 'what doesn't work' in terms of how

well different school architectures support the contemporary educational practices of teachers and learners.

This paper describes the development of an evaluation tool aimed at gathering evidence about the pedagogical performance of school buildings. The School Spaces Evaluation Instrument (SSEI) was developed to inform school leaders, teachers, asset managers and architects about 'what works' when designing new schools or refurbishing existing facilities. The long-term aim of the SSEI project is to create a database that can collate data about the qualities of different school building typologies (Dovey & Fisher, 2014) and to subsequently generate progressive planning and design principles/guidelines.

2. Literature review

Post-occupancy evaluation (POE) was defined by Zimring and Reizenstein (1980, p. 429) as "the examination of the effectiveness for human users of occupied designed environments" and by Preiser (2002) as "a process of systematically evaluating the performance of buildings after they have been built and occupied for some time" (p. 42). The information gained through building evaluations may be valuable to a range of stakeholders, including those engaged in new building projects and those who wish to gain enhanced value from the spaces they already have.

Many studies have evaluated educational facilities using POE techniques (Preiser, 2002; Preiser and Nasar, 2008; Ornstein *et al.*, 2009). Most of these studies have tended to focus on the technical performance of buildings and have not considered their suitability for various forms of pedagogical practice. Most examine the fitness for purpose of facilities in a technical way, using energy and other services analytics and observational studies.

With the recent development of new building typologies in many developed countries that are intended to support contemporary approaches to teaching and learning, the evaluation of such learning environments has become an important issue (OECD, 2009a; 2009b). In keeping with change in the design of learning spaces, the focus of post-occupancy evaluation in education has begun to shift. The creation of 'innovative' learning environments has encouraged researchers to search for novel evaluation methodologies and methods that can be used to assess the effectiveness of educational facilities in supporting the learning process (Radcliffe *et al.*, 2008). Such a shift appears to represent renewed interest in evaluation at the intersection of the physical and the social and a return to the origins of POE in environmental psychology (Zimring & Reizenstein, 1980). It also supports Preiser and Nasar's (2008) opinion that a new perspective on building evaluation is emerging that values the opinions of users, and Ornstein *et al.*'s (2009) conclusion that,

"user-informed assessments increase the likelihood that a given school building fulfils its intended educational purposes to the greatest degree possible" (p. 364).

In 2008, Temple concluded that,

"further research is needed to illuminate the connections between space and institutional effectiveness" (p. 229).

Subsequently, in a paper titled *The evaluation of physical learning environments: a critical review of the literature*, Cleveland and Fisher (2014) identified the following key issues and aspirations in the field of learning environment evaluation:

- A number of tools have been developed to evaluate school learning spaces. Most focus on features of the physical environment itself, rather than on the influence of architecture on teaching and learning practices, activities and behaviours.
- Poor indoor environment quality (IEQ) can lessen the effectiveness of good pedagogy.
- New evaluation methodologies are required if we are to understand what types of learning spaces can support the educational programs and practices of the 21st century.
- Evaluations that assess the alignment of space and learning are in their infancy and require further development.
- Evaluation approaches and tools are required that can be modified to accommodate specific physical and social contexts, and the various interests of those commissioning evaluation.

3. Development of the SSEI framework

SSEI was developed to address the shortcomings of existing school learning environment POE tools. It is composed of three modules that can be used to evaluate general-purpose teaching and learning spaces in primary and secondary schools.

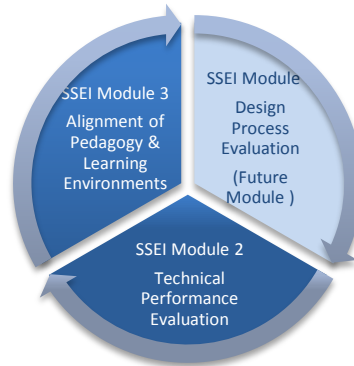


Figure 1: The School Spaces Evaluation Instrument (SSEI) framework.

The three SSEI modules are:

- SSEI Module 1 – Design Process Evaluation (Future Module)
- SSEI Module 2 – Technical Performance Evaluation/Indoor Environment Quality (IEQ)
- SSEI Module 3 – Alignment of Pedagogy and Learning Environments

Each module has a different focus. Module 1 focuses on the process of design and the performance of the design team; Module 2 focuses on indoor environmental conditions and sustainability; and Module 3 focuses on the alignment of teaching and learning activities and the design of the learning environment. These modules may be used independently or all three may be applied to generate an evaluation that integrates a range of different perspectives on the quality and performance of educational facilities.

3.1. Overview of SSEI Module 3

SSEI Module 3 was developed based on the following premise:

If learning environments are to be assessed for the ways they can support desired teaching and learning practices, activities and behaviours, they must be assessed subjectively within the context of the educational model(s) they are intended to support. Furthermore,

“such assessments should be based on the educational visions that informed the design and on the opinions of the school leaders, teachers and students who experience the complex physical and social interactions that occur in these learning environments following occupation” (Cleveland, 2011, p. 245).

The purpose of SSEI Module 3 is to:

- Evaluate the alignment between desired teaching and learning activities and the design of learning environments (general purpose) in primary and secondary schools.
- Generate data that can inform decisions about the design and use of learning environments.

SSEI Module 3 collects information about a school’s educational objectives and uses that information to evaluate the alignment between teaching and learning activities and the design and use of space. The information collected refers specifically to the educational objectives associated with the learning space(s) being evaluated. This approach distinguishes SSEI Module 3 from other school post-occupancy evaluation tools, as it (1) recognises that the educational values and beliefs of a school community (and its parent agency) should inform learning environment evaluation, and (2) enables information about a school’s context, culture, educational philosophy and vision for learning to be integrated into the evaluation process. Figure 2 (below) outlines the general relationships between pedagogy and learning environments, as conceived for the purposes of the tool.

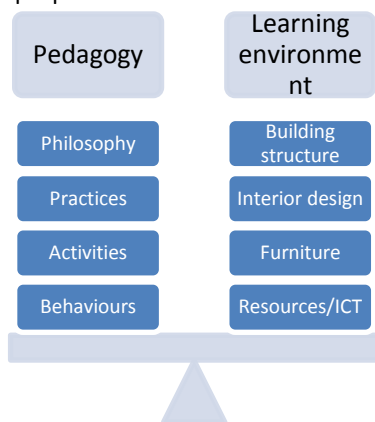


Figure 2: Aligning pedagogy and learning environments.

4. Development and pilot testing of SSEI Module 3

This study investigated the development and pilot testing of SSEI Module 3. The study involved (1) further development of the module in readiness for conducting evaluations in schools and (2) pilot testing to determine the future viability of the tool. The development and pilot testing of the module was driven by the following research questions:

- How can the pedagogical effectiveness of school learning environments be evaluated?

- How effective is SSEI Module 3 in evaluating the pedagogical effectiveness of school learning environments?

4.1. Methodology and methods

Following initial development of SSEI Module 3, it was pilot tested in five schools between July 2012 and February 2013. Convenience sampling (Bryman, 2004) was used to select specific samples (schools and individual participants) for investigation. Participants from within each school were identified in consultation with school Principals based on the following criteria: (1) their willingness to participate in the study; (2) their familiarity with the space(s) being evaluated. School leaders, teachers and students were invited to participate in the study. This invitation was supported by written plain language statements and consent forms.

Participant numbers varied between schools depending on how many people regularly used the learning environment(s) being evaluated. Overall, five Principals, four Assistant Principals, 40 teachers and 222 students participated in the study. In addition, the CEM Regional Managers from each of the four metropolitan regions took part in the focus group events associated with the school(s) in their region.

To evaluate the evaluation program/pilot study, data were collected in the form of complete SSEI Module 3 Final Reports, as well as field notes taken by the researchers during focus groups and later discussions with school Principals and CEM staff. These field notes were analysed using a process of thematic narrative analysis (Riessman, 2008).

Data collection associated with the pilot evaluations was acquired using three methods: online surveys (school leaders, teachers and students), an expert facilitated observational walkthrough (school design expert and teachers) and a focus group (school leaders, teachers and Regional Managers). This iterative process supported a 'drill down' approach that enabled the key evaluation issues arising at each school to be thoroughly investigated. These data were distilled into final reports for each evaluation.

4.1.1. What participants were asked to do

The evaluation process at each school was led by an Infrastructure Project Officer from CEM, and supported by school leaders and teachers at each site – as required by the design of the module. The specifics concerning what each group of participants were asked to do in relation to (1) the actual evaluation process, and (2) the set-up and review of the evaluation process, is outlined below:

- Principals and/or Assistant Principals were interviewed and asked to provide background information regarding their schools' facilities and educational vision (60 minutes). They were also asked to complete a survey (50-60 minutes), report on the results of the teacher and student surveys (3-5 hours) and participate in a focus group (60 minutes).
- Teachers completed a survey (20-25 minutes). A sub-sample of teachers at each school also participated in the observational walkthrough (2 hours) and a focus group (60 minutes).
- Students (Year 4 and above) completed a survey (15-20 minutes).
- An Infrastructure Project Officer from CEM led the observational walkthrough (2 hours) and focus group (60 minutes) at each school and wrote interim and final reports for each participating school (10 hours approx.).
 - CEM Regional Managers attended a focus group (60 minutes).

4.1.2. Analytical framework

To investigate the research questions, an analytical framework was devised to enable the evaluation program/pilot study to be evaluated.

Table 1: Analytical framework used to evaluate the evaluation program/pilot study. (adapted from: Larson & Berliner, 1983)

Inputs (resources and methodologies employed for the evaluation program/pilot study)	Process (conduct of the evaluation compared with that planned in the evaluation design)	Outcomes (decisions influenced by the evaluation program/pilot study)
SSEI Module 3 objectives: Provide an informative evaluation using a straight forward and cost effective process.	SSEI Module 3 objectives: Involve a range of stakeholders in the evaluation and share the 'lessons learned'. Support improved communication between the various stakeholders involved in school design. Provide feedback for school communities about the design and use of their learning environments. Improve the functional fit between school communities and their facilities. Provide feedback for education agencies about the design and use of the learning environments in their schools.	SSEI Module 3 objectives: Support continuous improvement in the design and use learning environments in primary and secondary schools. Support the development of online databases that can be used for benchmarking and to create online resource banks that illustrate best practice in learning environment design and use. Establish advisory guidelines/principles that can inform the master planning, design and use of teaching and learning environments in primary and secondary schools.
Evaluation factors: Duration of the evaluation program/pilot study. Timing of the evaluation program/pilot study. Skills of evaluation personnel (e.g. training, experience, "world view"). Skills of program personnel (Principals, teachers and students) e.g. experience, commitment, capacity. Budget and other resources available for the evaluation program.	Evaluation factors: Types, intensity and frequency of interactions between evaluators and program participants. Extent to which acquired information was fed back to program participants. Adaptiveness of evaluation design. Methodology: the formal and informal processing of information leading to evaluative findings. Communication of findings to various stakeholders.	Evaluation factors: Decision by program participants or funding agency to modify any of the evaluation program/pilot study procedures. Decision by program participants or funding agency to act on outcomes of the evaluation program/pilot study. Decision by one or more members of the research community to study further questions/issues raised in the evaluation program. Decision by one or more other funders to initiate, modify, or terminate similar programs.

The framework shown in Table 1 (below) was based on the broad objectives of SSEI Module 3 and integrated with an evaluation framework adapted from Larson and Berliner (1983). Using a process of qualitative analysis, this framework was used to evaluate the relative success of the evaluation program/pilot study.

5. Findings and discussion

In keeping with the analytical framework shown in Table 1, the key findings of the study are presented below under the following headings; inputs, process and outcomes.

5.1. Inputs

The total time taken to complete each pilot evaluation was 4-5 months – an elongated period due to the limited availability of the Regional Managers. Had these people not been required, the duration of the data collection processes could have been achieved over six weeks and the entire evaluation process could have been completed in 8-9 weeks.

School leaders suggested that data collection should take place in the later part of Term 1, or early in Term 2, and that final reports should be completed during Term 3 to enable them to act upon the evaluation outcomes ahead of the following year.

An Infrastructure Project Officer from CEM led the evaluations at each of the five participating schools, following a briefing on the evaluation process. As all five pilot evaluations were completed successfully, this briefing and the information contained in the SSEI Module 3 User Guide appears to have provided adequate information about how to conduct the evaluation process.

Students (Year 4 and above) were reported to have had no difficulties answering the survey questions in four of the five pilot schools. At one school it reported that the ‘younger students’ required assistance to ‘unpack’ some of the questions. Across all five pilot schools, teachers and Principals were readily able to answer the survey questions. Teachers and Principals were readily engaged in the observational walkthroughs and focus groups. One Head of Learning and Teaching commented that, “the walkthrough was the most enlightening hour of last year”.

The analysis and reporting on the survey questions was conducted by school leaders from within participating schools. These people were able to follow the analysis process, as set out in the User Guide, and complete this process in 3-5 hours. One aspect of evaluation process that was not completed by any of the pilot schools was the forwarding of master plans, schematic design drawings and photographs of the spaces/facilities being evaluated. These documents/images were not forthcoming.

The major costs involved in conducting the evaluations were associated with human resources. The time required for the various groups to participate in the evaluations were in keeping with initial expectations (please refer to section 4.1.1).

5.2. Process

The SSEI Module 3 pilot study showed that the evaluation process could be conducted as planned. However, it revealed that improved methods for delivering the instrument and managing the data collected could lead to a more efficient, and potentially more effective, evaluation process.

The evaluators were well received at each pilot school. Principals and teachers reported that they found the observational walkthrough to be a positive and enlightening experience. Program participants

were forthcoming with comments and discussion points during the focus groups. Email and telephone correspondence was adequate for the purposes of supporting the evaluation process.

The participation of Principals and teachers in the observational walkthrough provided them with an opportunity to contribute to and engage with the information acquired, while the focus groups promoted the formal feedback of early findings and further discussion with participants. It was suggested that a fourth phase should be added to the evaluation process, asking participating schools to identify what actions they have or intend to take in response to the evaluation reports produced.

A number of CEM staff and Principals suggested possible modifications to the evaluation design to make it more adaptable. These suggestions included, (1) making it possible to record impromptu points/issues in the observational walkthrough questionnaire, (2) including the voices of teacher aids in the evaluation and (3) including the voices of Prep-Year 3 students in the evaluation.

The processing of data collected via surveys was collated by school leaders, while the data collected via observational walkthroughs and focus groups was done by CEM staff. Both processes met with expectations. However, it was suggested that the creation of a bespoke online interface should be explored to support more efficient collection and processing of data.

It was suggested that summaries of school evaluations, including schematic design drawings and images, should be made available to a wider audience via an online resource bank. Such a resource could broadcast valuable information to school communities and architects about the issues pertaining to the alignment of pedagogies and learning environments. The value of a resource bank would be further enhanced by periodic meta-synthesis of the data held in it, along with the publication of such findings.

5.3. Outcomes

The pilot study showed that the outcomes of the evaluations were valued by the participant schools. The feed-forward outcomes of the evaluations were acted upon in a number of different ways. Information derived from the evaluations informed the renovation of existing spaces at one school and the design of new spaces at another. Furthermore, the evaluation findings from the second school were taken into consideration in connection with the design of spaces at two further schools. A number of pilot schools also embedded discussion of learning environments into their professional learning programs. Table 2 (below) provides a brief summary of the issues that were identified as 'in need of attention' at each pilot study school.

Table 2: Summary of issues highlighted in evaluations for each pilot study school. Issues marked 'X' identified as issues in need of attention.

Issue	School A (Primary)	School B (Secondary)	School C (Primary)	School D (Primary)	School E (Primary)
Spatial/physical issues					
Differentiation of activity settings limited	X	X		X	X
Furniture and joinery in large common area not supportive of differentiated activity settings	X	X			X
Indoor environment quality in need of better management by staff	X		X	X	
Acoustics in large common area poor		X		X	
Connections between indoor and outdoor learning spaces limited	X				X
Parent gathering spaces (outdoors) limited			X		
Locker areas problematic		X			X
Multimedia display technology limited		X			
Airflow/cross ventilation insufficient		X			
Display space limited		X			
Storage space limited		X			
Artificial lighting control insufficient			X		
Pedagogical/social issues					
Large common area underutilised	X	X		X	X
Teacher professional learning required	X	X		X	
Shared vision for learning and teaching in common areas lacking		X		X	
Student and teacher ownership and mastery of common areas lacking		X		X	
Teacher meeting room(s) potentially better utilised as breakout spaces for students	X	X			
Breakout room (small) underutilised			X		
Pedagogical and spatial transitions between primary and secondary school in need of closer consideration		X			
Inflexible timetable restricting the variety of activities undertaken in common area		X			

6. Conclusion

This study indicated that further research/development of SSEI Module 3 was warranted. The evaluation program/pilot study showed that such attention should focus on the development of an online system that provides the capacity to (1) disseminate briefing materials on how to conduct evaluations to evaluators and participating schools, (2) host the survey tools, (3) streamline data management and analysis, (4) store the outcomes of the evaluations in a database that would enable the meta-synthesis of selected evaluations to produce 'big picture' lessons learned and (5) develop an online system that showcases case studies of effective learning environments and disseminates the findings of meta-synthesis studies.

With the backing of CEM, this work is currently underway and a program of evaluation has been agreed for the next three years (2015-2017). The *Towards Effective Learning Environments in Catholic Schools: An Evidence Based Approach* project will develop an evidence base to inform both the design and pedagogical use of learning spaces (school facilities) in the Catholic schools in the Melbourne Diocese – and hopefully beyond as the project is expanded to other parts of Australia.

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