

LEARNING ENVIRONMENT EVALUATION AND THE DEVELOPMENT OF SCHOOL FACILITY DESIGN GUIDELINES

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Abstract

Australia has been the site of significant school facility design innovation during the past decade. This innovation was showcased in 2013 in a report released by the Organisation for Economic Cooperation and Development (OECD) titled *Innovative Learning Environments, Educational Research and Innovation*. It featured case studies of 40 exemplary schools from around the world. Of these, seven were from Australia, including six from Victoria.

While international attention directed towards the designs of Australian schools is nice, there remains little empirical evidence to attest to the effectiveness of these and other innovative school facilities in supporting desired and emerging pedagogies in primary and secondary schools.

The Towards Effective Learning Environments in Catholic Schools: An Evidence Based Approach (TELE) project was set up in 2015 as a collaborative research initiative between Catholic Education Melbourne (CEM) and the Learning Environments Applied Research Network (LEaRN) at the University of Melbourne. Over three years (2015-2017) the project aims to develop empirical evidence and subsequent guidelines that can aid decisions about how best to design and use of learning environments (school facilities) in primary and secondary schools.

During the course of the project, the pedagogical effectiveness of 36 learning environments in primary and secondary schools will be evaluated across the Melbourne Diocese using LEaRN Evaluation Module 3 – Alignment of Pedagogy and Learning Environments. In doing so, the project seeks to answer the following questions: 1) How can Catholic school learning environments be designed and used to best pedagogical effect?; 2) How well aligned are contemporary pedagogies with the designs of learning environments in Catholic schools in the Melbourne Diocese?; 3) What influence do different building typologies have on this alignment?; 4) How can the alignment between contemporary pedagogies and the design of school learning environment be improved?; and 5) Is there any correlation between the relative alignment of pedagogies and learning environments and the learning outcomes achieved by students (non-causal)?

For the purposes of the project, learning environments have been delineated by the adjoining spaces used by a class, cohort or year level at the same school, including shared zones that have consistent physical features. Five spatial typologies (A to E), as identified by Dovey and Fisher (2014), have been used to group learning environments with similar spatial arrangements. These typologies are differentiated by their relative degree of openness, from traditional classrooms (enclosed) to permanently open-plan spaces (open). Using a strategic sampling technique, an even distribution of each building typology will be evaluated over the course of the three-year project to help identify which learning environments (including furniture, fit-out, and cultural practices) are the most supportive of contemporary pedagogies, as envisaged by CEM and the participating schools.

This paper reports on progress towards the development of evidence-based guidelines for the design of contemporary schools, as derived from the program of learning environment evaluation described above.

Introduction

The Towards Effective Learning Environments in Catholic Schools: An Evidence Based Approach (TELE) project was set up in 2015 as a collaborative research initiative between Catholic Education Melbourne (CEM) and the Learning Environments Applied Research Network (LEaRN) at the University of Melbourne. It draws on a five year research partnership between the two parties, founded on a common interest in wishing to improve the design and pedagogical use of school facilities through learning environment evaluation (Cleveland & Soccio, 2015).

The overarching research questions being addressed by the project are:

- 1) How can Catholic school learning environments be designed and used to best pedagogical effect?
- 2) How well aligned are contemporary pedagogies with the designs of learning environments in Catholic schools in the Melbourne Diocese?
- 3) What influence do different building typologies have on this alignment?
- 4) How can the alignment between contemporary pedagogies and the design of school learning environment be improved?
- 5) Is there any correlation between the relative alignment of pedagogies and learning environments and the learning outcomes achieved by students (non-causal)?

The ultimate goal of the project is to develop evidence-based guidelines that can aid decisions about how best to design and use learning environments (school facilities) in primary and secondary schools. With numerous new schools to be built over the coming decade, and many more to be upgraded and/or refurbished, both parties agreed that a rigorous program of evaluation was needed in order to collect evidence about the design of school facilities that can inform future decision making.

Such an approach aligns with Davison's (2004) suggestion that evaluations are generally conducted for two purposes:

- 1) To find areas for improvement; and/or
- 2) To generate an assessment of overall quality or value for reporting or decision making purposes.

With a focus on a) guideline development and b) organisational capacity building, the project has also adhered to Davison's recommendation that it is important to adopt a more relational, rather than realist, framing of evaluation and include a high degree of stakeholder participation. Indeed, the project 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. 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).

Reflecting the strong partnership arrangement between CEM and LEaRN, the fieldwork has been/will be jointly conducted by Project Officers from CEM's planning and infrastructure divisions, as well as researchers from the University of Melbourne. The involvement of CEM in fieldwork is intended to support stakeholder participation and organisational capacity building. In turn, this is hoped to support deeper conceptual understandings within the organisation of how the anticipated design and pedagogical use guidelines can be implemented to best effect.

As part of the foundational research conducted prior to the commencement of the TELE project, a suite of three evaluation modules were developed and piloted between 2011-2013 by LEaRN with the support of CEM to address the shortcomings of existing learning environment post occupancy evaluation (POE) tools (Cleveland & Fisher, 2014; Imms, Cleveland & Fisher, 2016). These encompass the following modules that can be used to evaluate general-purpose teaching and learning spaces in primary and secondary schools:

- LEaRN Evaluation Module 1 – Design Process (Future Module)
- LEaRN Evaluation Module 2 – Technical Performance/Indoor Environment Quality (IEQ)
- LEaRN Evaluation Module 3 – Alignment of Pedagogy and Learning Environments¹

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 building performance (sustainability) and indoor environment quality; 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 and the design processes that deliver them (Cleveland & Soccio, 2015).

Over three years (2015-2017), the TELE project will use LEaRN Evaluation Module 3 – Alignment of Pedagogy and Learning Environments to evaluate selected learning environments in 36 schools across the Melbourne Diocese in order to develop an evidence base that can be developed into guidelines for the design and pedagogical use of learning environments in Catholic primary and secondary schools. The project builds on the findings of a pilot evaluation study that was undertaken in five Melbourne Diocese schools in 2011-13 (Cleveland & Soccio, 2013).

The overarching questions addressed by LEaRN Evaluation Module 3 – Alignment of Pedagogy and Learning Environments are as follows. Numbers of sub-questions relate to each of these generalised variables.

Qualities of the learning environment:

- Do students and teachers like the character and aesthetics of the learning environment?
- Is the learning environment readily accessible?
- Do students and teachers feel safe in the learning environment?
- Does the overall size and scale of the learning environment support a variety of learning modalities?
- Does the learning environment provide suitable activity settings to support the desired learning activities?
- Does the furniture support the desired learning activities?
- Does the learning environment provide opportunities for agile and flexible use?
- Is the learning environment adequately resourced?
- Is adequate display space provided?
- Is there adequate provision for the storage of resources?
- Can students access toilets safely?
- Does the learning environment provide a comfortable setting for learning?

¹ Previously, these evaluation modules were referred to as the School Spaces Evaluation Instruments (SSEI).

Culture and practice of the learning environment:

- Does the timetable support the desired pedagogies and learning activities?
- Does the movement of people and objects (furniture and resources) align with the desired pedagogies and learning activities?
- Do students demonstrate affinity for, and mastery and ownership of, the learning environment?
- Is display space used effectively to communicate with all members of the learning community?

Teacher support spaces:

- Are teaching support spaces well located and designed?
- Are teachers supported with professional learning opportunities to employ the pedagogies desired by the school?

General impressions of the learning space:

- Overall, does the learning environment support the desired teaching and learning practices and activities?

This paper outlines the some of the early findings arising from the first year of the TELE project and discusses and how the findings may contribute towards the development of afore mentioned guidelines.

The TELE research project – Year 1 (of 3)

The TELE project is made-up of three separate, but complementary, studies. Study 1 was completed in 2015. It involved the development of an online survey tool and database for storing and analysing the data collected. Study 2 will involve the annual evaluation of 12 learning environments (2015-2017) and the meta-synthesis (Walsh & Downe, 2005) of these findings for the purpose of identifying key issues worthy of consideration for guideline development i.e. the ‘big picture’ lessons learned about the ‘design’ and ‘use’ variables that contribute to effective learning environments. Study 3 will explore possible correlations between the findings arising from Study 2 and a range of data about school performance and student learning outcomes.

For the purposes of the TELE project, the term ‘learning environment’ is used to describe the spaces used for formal and informal teaching and learning. A ‘learning environment’ is inclusive of the building structure, interior design, furniture, loose items, and information and communication technologies. The learning environments evaluated in the project have been delineated by the zones of adjoining spaces that are used by a class, cohort or year level at the same school. In the first year of the Study 2 these areas accommodated between 50-250 students depending on the school and learning environment sampled for the project.

Table 1 (below) outlines the five spatial typologies identified by Dovey and Fisher (2014) that have been used as a sampling strategy to identify learning environments that are of fundamentally different spatial configurations. These typologies are differentiated by their relative degree of openness, from traditional classrooms (Type A – enclosed) to permanently open-plan spaces (Type E – open).

Table 1: Learning environment (school facility) spatial typologies identified by Dovey and Fisher (2014).

Spatial type	Description of the physical learning environment
A (enclosed)	A cluster of traditional classrooms connected by a [central] corridor.
B	Similar to Type A, except that the corridor connecting the traditional classrooms is widened to create a breakout space, identified as 'street-space' or 'learning commons'.
C	Walls between adjoining classrooms (but not the breakout space) are made flexible, enabling these classrooms to be opened-up, creating a new space identified as 'commons'.
D	Walls between adjoining classrooms and the breakout space are flexible, allowing for the entire learning environment to become one larger space, whilst also retaining the ability to close it down into traditional classrooms.
E (open)	The learning environment is open plan and cannot be converted into traditional classrooms without major renovation.

These typologies are represented visually below. It should be noted that these representations are only intended to succinctly communicate the types of spatial arrangements and proximities that distinguish one typology from another. In reality, a variety of floor plans can be identified as being aligned with each typology.



Figure 1: A visual representation of the five learning environment (school facility) typologies defined by Dovey and Fisher (2014), adapted by the authors.

Using a stratified sampling technique, a distribution of each typology will be evaluated over the course of the three year project to help identify which spatial arrangements and other learning environment variables are the most supportive of contemporary approaches to teaching and learning, as envisaged by CEM and the participating schools.

The information collected by Module 3 specifically relates to the educational objectives associated with the learning environment(s) being evaluated. The methodology:

- 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 (Cleveland & Soccio, 2015, p. 510).

This is significant as it recognises that the value of a given learning environment is relative to its intended use i.e. the alignment of pedagogy and space is assessed, rather than each evaluation being based on a generalist set of pedagogical values and beliefs that may not be those of the participating school/parent agency.

Research methodology and methods

Methodology and sampling

In 2015, 12 learning environments found in eight primary schools and three secondary schools were evaluated². These were selected using a success-based case study methodology and the stratified sampling strategy discussed above i.e. the learning environments were identified and sampled based on Dovey and Fisher's (2014) typologies.

The sampling strategy also took into account a number of other variables. One-third of the learning environments were sampled from secondary schools and two-thirds in primary schools. The schools were selected from the four CEM regions and on average collectively rank close to 1000 on the Index of Community Socio-Educational Advantage (ICSEA). Only general purpose learning environments were evaluated (no specialist spaces). The number of type A/B, C, D and E learning environments were to be equal across the duration on the study (i.e. nine of each typology were to be evaluated over the three years, excepting A/B which were to be sampled together), while allowing for some variation each year. And finally, the age of the sampled learning environments may vary, but new learning environments should have been occupied for a minimum of six months before being included in the study to allow teachers and students time to 'settle in' and become familiar with the enabling and constraining factors associated with their spaces.

Methods

LEaRN Evaluation Module 3 – Alignment of Pedagogy and Learning Environments involves three phases of fieldwork. Phases 1 and 2 involve a school leader (Principal or Deputy Principal), a learning environment expert (LEE), and a select group of teachers and students completing an online survey about the learning environment being evaluated. The school leaders' survey contains 31 long answer questions about the school's educational vision and desired pedagogy. In Year 1 of the TELE project, nine Principals and two Deputy Principals across the participating schools completed the leadership survey. The LEE, teacher and student surveys contain 69 long answer, short answer and multiple-choice questions about the pedagogy, physical space and affordances of the learning environment. The multiple-choice questions are positively framed and require the participants to 'strongly agree',

² Two learning environments of different typologies were evaluation at one secondary school.

'agree', 'disagree' or 'strongly disagree' with the questions posed. In 2015, four LEEs, 82 teachers and 829 students completed these surveys. The LEE surveys were completed by leading educators with school facilities experience from within the Catholic education system following an observational walkthrough of each learning environment being evaluated. An 'observational walkthrough' is an established architectural observation method where an expert uses a 'checklist' to evaluate the 'performance' of specific spaces within a site. The duration of these walkthroughs was dependent on the size/scale of the learning environment being evaluated. The LEE's survey responses were supported by discussion with one or two teachers from the participating school and/or a school leader about the user groups' lived experience of the spaces.

Phase 3 of the fieldwork involves a one-hour focus group attended by the participating teachers, school leaders and LEE. At these focus groups, the results of the surveys were presented and those assembled were asked targeted questions arising from a preliminary analysis of the survey results about how the learning environment enabled or constrained the students and teachers from achieving the school's educational vision and/or desired pedagogy. For presentation, the survey questions were grouped into overarching themes and the results mapped on graphs to aid visual communication of the three respondent groups' unique perspectives about the learning environment. In 2015, there were 12 one-hour focus groups held in the 11 participating schools. Between two and fourteen teachers, plus the LEE and at least one school leader were present at each.

Data analysis

Data collection in 2015 resulted in over 80,000 data points being imported into the TELE project database about the design and use of the twelve learning environments evaluated. At the local level, each of the participating schools received an evaluation report. This contained a summary of the data collected about their learning environment, as derived from the three-phase evaluation process. At the system level, the findings from across the 12 learning environments were analysed through a process of qualitative meta-synthesis to develop some overarching findings arising from the first year of the study.

Two distinct approaches to meta-synthesis of data are described in the literature: 1) qualitative meta-synthesis and 2) quantitative meta-synthesis. Walsh and Downe (2005, p. 204) describe the key differences between these approaches as:

The latter [quantitative] aims to increase certainty in cause and effect conclusions in a particular area, while the former [qualitative] is more hermeneutic, seeking to understand and explain phenomena.

Given that the aim of the project is to understand and explain phenomena associated with teachers and students lived experience of different types of learning environments, a qualitative approach was adopted for meta-synthesis of the Study 2 evaluation data. This is in keeping with the overarching objectives of the project to; a) develop big picture lessons learned about the design and use variables that contribute to effective learning environments; and b) develop guidelines to inform the design and pedagogical use of learning environments. It is envisaged that at the end of three year project, the lessons learned will be formalised into a set of CEM school facility design guidelines and policies, as well as provide information for Catholic school communities about how to use learning spaces to best pedagogical effect.

Applying Walsh and Downe's (2005) qualitative approach to meta-synthesis to the findings of the 12 evaluations involved the following:

- 1) Establishing a grid of key concepts;
- 2) Reviewing each study (evaluation) and undertaking an interpretative synthesis about how the findings may relate to the key concepts – with the aim to identify homogeneity of categories, codes and/or themes across the studies and note any dissonance;
- 3) Upon completion of the review, comparing and contrasting all of the findings, as they relate to the key concepts;
- 4) Overlaying the qualitative data arising from the focus group forums on the survey data.

Findings

Adopting an appreciative lens, some of the early 'lessons learned' from the evaluations conducted in the first year of Study 2 are outlined below. These were identified using Walsh and Downe's (2005) qualitative approach to meta-synthesis, as applied to the findings of the 12 evaluations conducted in 2015. Although more variables could be discussed, this paper limits discussion to the five most favourable 'design and use variables' found to contribute to the effectiveness of the learning environments evaluated in 2015.

At this early stage of the project, only indicative analyses is given on the basis of learning environment typology, due to the small sample sizes in the first year of the study. More detailed analysis on the basis of learning environment typology will be undertaken based on the findings for the overall program of evaluation.

The five most favourable variables of the 12 learning environments evaluated in 2015

The following is a summary of the key findings arising from the first year of the study. The five most favourable variables of the 12 learning environments evaluated in 2015 were:

- 1) Safety in the learning environment, as experienced and perceived by users.
All twelve learning environments evaluated were considered to be safe for students and teachers.
- 2) The range of pedagogical encounters supported by the learning environment.
All learning environments evaluated were considered to be supportive of a range of pedagogical encounters. However, some learning environment typologies were found to be more supportive of certain encounters than others. For example, small group work was identified as challenging in type A and B learning environments, while whole class work was identified as challenging in type E learning environments.
- 3) The ability for teachers to supervise students in the learning environment
Generally, the learning environments evaluated were found to afford teachers a high level of supervision over students. Type A and B learning environments were found to be less supportive of teacher supervision than type C, D and E learning environments.
- 4) The range of professional development opportunities which are offered to staff.
The majority of teachers (86%) felt supported to employ the pedagogies desired by their school.
- 5) The learning environments provide teachers and students with adequate space.
Students, teachers and learning environment experts were generally comfortable with a) the

number of people who occupied the learning environments evaluated and b) the amount of space provided for teachers and students to complete their work.

For each of the five variables outlined above, further details of the findings are outlined below.

1) Safety in the learning environment, as experienced and perceived by users

The 2015 data showed that students, teachers and LEE's regarded the learning environments across all schools to be safe environments for students and teachers. Based on the phenomenological data collected during the focus groups, the following design and use variables were identified as contributing to creating to a safe environment for students and teachers:

- Surroundings that are familiar (including the space, friendship/peer group and teachers);
- Teachers having clear sightlines through the learning environment;
- Teachers having clear sightlines of entry points into the learning environment;
- The provision of toilet facilities which are accessible from inside the learning environment;
- Protection of the learning environment within the school grounds;
- The presence of multiple teachers inside the learning environment;
- Well understood safety procedures;
- Feelings of trust amongst staff and students; and
- Proactive staff and students who clean-up after themselves and alert others to potential dangers.

2) The range of pedagogical encounters supported by the learning environment

Students, teachers and LEE's generally regarded the learning environments to be supportive of a range of pedagogical encounters. However, type A and B learning environments were found to be less conducive to supporting small group work than type C, D and E learning environments. It was also found that whole class work can be difficult to support in all of the learning environment types, relative to the other types of encounters. Based on the phenomenological data collected during the focus groups, the following variables were found to influence small group work in the learning environment:

- The number of students in the class;
- The amount of usable floor area;
- The allowable distance between small groups;
- The amount and layout of the furniture;
- The agility and re-configurability of the furniture; and
- Visibility and sightlines between adjoining learning spaces.

The following variables were found to influence teachers' facilitating whole class activities in the learning environment:

- The nature of the whole class activity;
- The ability to open-up and/or close-down the learning space to match the activity;
- The ability to move to 'another' learning space more conducive to whole class activities;
- The noise levels for students participating in the activity;
- The noise levels generated by the activity (that may disturb others); and
- The quantity and layout of the furniture.

3) The ability for teachers to supervise students inside the learning environment

The 2015 data revealed that all of the learning environments afforded teachers a level of supervision over students. However, type A and B learning environments were found to be less supportive of teacher supervision than types C, D and E. Based on the phenomenological data collected during the focus groups, the following findings were identified about the design and use variables that can impact teachers' ability to monitor what students are doing in the learning environment:

- Clear sightlines into and around the learning space, including from adjoining spaces. This may be aided by the use of glass (full or half-height) and/or half-height furniture items (e.g. lockers and shelves) which do not obstruct views;
- Teachers being able to move easily through and between spaces to access students;
- Strategic placement of mirrors around the learning space;
- The number of teachers working in the learning space – with more than one often better;
- The type of pedagogy being employed (e.g. roaming teachers to aid supervision); and
- The number of students in the class, as it applies to the area available per student – with limited area causing difficulties due to limitations on teacher movement.

4) The range of professional development opportunities, which are offered to staff

The majority of teachers (86%) reported feeling supported to employ the pedagogies desired by their school. Eight of the nine teachers (13%) who disagreed with the level of professional learning support provided by their leadership team worked in secondary schools, including four who worked in the same type B learning environment. Based on the phenomenological data collected during the focus groups, the following factors were found to have a positive impact on professional development and the pedagogical support experienced by teachers:

- Teacher mentoring programs;
- Teacher access to information and/or examples of desired pedagogies;
- The presence of school leaders as teachers in the learning environments;
- The type and range of opportunities that teachers have to participate in discussions/feedback about the desired pedagogies with school leaders; and
- Timetabling classes to positively reinforce the school's preferred pedagogies.

5) The learning environments provide students and teachers with adequate space

All of the survey respondents were generally comfortable with the number of people who occupied the learning environments across all 12 schools, as well as the amount of space provided for teachers and students to complete their work. Based on the phenomenological data collected during the focus groups, the following factors were identified to have an impact on teachers' and students' personal comfort and ability to do their work in the learning environment due to relative crowding:

- The ease with which people can move around the learning space;
- The suitability of the furniture for the size of learning space and age of the students;
- The general (sense of) spaciousness;
- The provision of break-out spaces/learning commons that can support a variety of activities;
- The level of background and acute noise; and
- The convenience of access to toilets.

The following factors were found to influence the amount of space teachers and students require to undertake their work:

- The number of students in a class/cohort relative to the size of the space;
- The pedagogy being employed by the teachers;
- The ease with which furniture can be moved and reconfigured;
- The ease with which people can move around; and
- Assess to breakout spaces and/or settings that cater for specific activities.

These preliminary findings, arising from the first year of the program of evaluation, are suggestive only of a small sample of the issues that will be considered in the development of the desired guidelines for the design and pedagogical use of learning environments in Catholic schools in the Melbourne Diocese. Many additional themes and issues will be explored, based on the data collected in 2015 and the subsequent two years (2016-2017).

Conclusion

This paper provided an outline of the program of learning environment evaluation currently being undertaken as a collaborative research initiative between Catholic Education Melbourne (CEM) and the Learning Environments Applied Research Network (LEaRN) at the University of Melbourne. It reported on the project's design (methodology and methods), and offered insights into the types of findings arising from the first year of evaluative activity.

At the end of three year project, it is envisaged that the 'lessons learned' about the alignment of pedagogies and learning environments will be distilled into a) a set of school facility design guidelines and policies for CEM, and b) information for school communities about how to use learning spaces to best pedagogical effect³.

With numerous new schools to be built over the coming decade, and many more to be upgraded and/or refurbished, the development of evidence-based guidelines that can inform facility design and the effective pedagogical use of learning environments is anticipated to have a significant and positive influence on school infrastructure and the 'spatialised pedagogic practice' of teachers and students.

³ Another LEaRN project is currently investigating this issue – ARC Linkage project, 'Innovative Learning Environments and Teacher Change' (2015-2018) (www.ilet.com.au).

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