

# Evaluating learning environments for interprofessional care

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## Abstract

Many institutions have invested considerably in the provision of student facilities – lecture halls, tutorial rooms and classrooms – spaces we call collectively learning environments. In expending resources on such facilities, we have assumed that we have needed to create this range of spaces for such activities. However, how do we know we have invested wisely in support of learning for interprofessional care? In this article I review the literature to identify evidence in a range of fields, including health care, to consider the issues and difficulties of employing established approaches from practices of evidence-based design. Central in this article is the role of evidence in the assessment of learning environments. In particular, I argue that the evidence must include qualitative dimensions of the learning experience. To address the qualitative outcomes from education, with particular attention to the concerns of interprofessional education, a model is proposed to examine different levels of outcomes. By developing an interpretation of Kirkpatrick's model, four levels are described for the effective evaluation of interprofessional learning environments.

## Keywords

Collective learning, evaluation research, interprofessional learning, interprofessional practice, work-based learning

## Introduction

There has been widespread investment in recent years in the provision of learning environments (e.g. student facilities, lecture halls, tutorial rooms and classrooms). Underpinning this expenditure is the assumption that such investments are justified. We assume, therefore, that we need these spaces for our learning activities. However, how do we effectively know we have spent our limited resources wisely in support of learning for interprofessional care context? In other industries, expenditures on buildings have been monitored, especially since the 1980s when asset deployment into buildings came increasingly under scrutiny. Industrial plants and office developments are monitored for productivity. Work has examined the effectiveness of healing in hospitals of different designs. There is considerable work in the design of corporate workplaces, from which I draw upon the field of post-occupancy evaluations.

Learning environments have not been subject to such a focus. By reviewing work to identify evidence in other fields, including health care, I consider the difficulties of established approaches from practices of evidence-based design. A core focus of this article is the role of evidence in the assessment of learning environments. In particular, I argue that the evidence must include the collection of qualitative data of the learning experience. To ensure qualitative outcomes from education are effectively captured, a model is proposed to examine different outcome levels. By developing an interpretation of the Kirkpatrick model, four types of outcomes are articulated for evaluating learning environments and describing its use for interprofessional learning.

## Evidence of contributions of place to health outcomes

Increasingly we read of the relationship between health care outcomes, physical experiences and the facilities in which the care is delivered (Glanville, 2004; Jones, 2006). Many of these reference early work by Ulrich (1984) in which we can trace a growth in evidence-based design in health care design. Is there any confidence in these claims of causal effects? Ulrich et al. (2008) examined the literature of empirical studies to answer three questions:

- (1) What can rigorous research tell us about “good” and “bad” hospital design?
- (2) Can improved design make hospitals less risky and stressful and promote more healing for patients, their families and staff?
- (3) Is there scientifically credible evidence that design affects clinical outcomes and staff effectiveness in delivering care?

The review identified a growing published base of evidence in correlations between constructed environments and outcomes in patient safety, other patient outcomes (e.g. stress, length of stay) and staff outcomes. As they note, this research obviously cannot progress by the methods common in medical research, particularly randomised control trials. While some studies, for example Blomkvist, Eriksen, Theorell, Ulrich, & Rasmanis (2005), have dealt with single variable changes (e.g. the replacement of sound reflective ceiling tiles with sound absorbent which led in turn to reduced stress levels in staff working in the space), the changes from one context to another are typically multi-variable changes, making direct comparison of one care environment to another more complex.

The review identifies that in some aspects of health care, direct correlations can be found between environmental conditions and outcomes. In particular, their findings indicate that single patient rooms (rather than shared), better environmental servicing of the rooms (air, light, views, sound, etc.) and better work flow considerations lead to improved patient and worker outcomes.

For example, single rooms reduced cross infections; improved patient sleep which in turn improved healing; improved privacy control and hence communication between patient, family and the caring team; supported greater social interaction; reduced staff stress; and increased patient satisfaction.

In a more focused study of literature, Velarde, Fry, & Tveit (2007) found a correlation between landscape views and health metrics (sick days, stress, etc.) but notes that the studies do not articulate differences in the effects between types of landscapes such as forests, water and flowers.

Among the work reported by Ulrich et al. (2008) is the Pebble Project of the Center for Health Design (Joseph & Hamilton, 2008), in which the authors note that the most significant challenges of the studies they have gathered are:

- Difficulty in getting started on the research.
- Greatly attenuated project timelines leading to difficulties in sustaining the studies over very long periods, often take over a decade, from project conception, briefing, documentation, tendering, construction to occupancy during which time project participants change several times.
- A paucity of research funding, compounded by the problems of the attenuated timeframes.
- A lack of standard metrics and tools, making comparisons difficult.

These problems are shared by those who research the effectiveness of learning environments.

## The corporate workplace

Health care is not the only field in which evidence-based design has been engaged. While corporate workplaces have been reviewed for effectiveness, the evidence in this field is less easily associated with direct outcomes. There are no equivalents of cross infection or patient days, although there is a common interest in staff outcomes.

Considerable research has been directed over the past 30 years at the influence of workplace design to productivity and worker satisfaction (Vischer, 2008). This research shows that there are direct correlations to satisfaction and comfort to productivity, not least because the absence of such conditions diverts attention from the task at hand or reduces attentiveness in decision making.

While workplace analyses may focus on productivity in terms of the delivery of contracted outcomes such as product or task completion, there is a particular aspect of this body of work that is of particular relevance in this context of learning environments. Knowledge work today relies on workplace learning as well, in particular, tacit learning. Tacit knowledge is passed along in every workplace in an unplanned manner and underpins competitive differentiation and innovation. The configuration of office workplaces is shown to affect opportunities for and effectiveness of tacit learning (Becker & Sims, 2001). Thus, we can find an indication in a substantive body of work that learning is affected by workplace design, at least in the corporate context.

## Gathering evidence

Axiomatically, evidence is the necessary basis on which design decisions are made in this paradigm. In a context in which causal links are tenuous, however, the evidence can be lead to facile conclusions. For example, Preiser & Nasar (2008) summarised that better designs tended to have a well-managed process; compatible exteriors and warm interiors; a gathering space (atrium) with lots of natural light; layouts and signs that made it easy for people to find their way around; and some focus on good acoustics. While certainly important advice, it is, in some respects, dangerous as it guides towards mediocrity.

To avoid an easily dismissed outcome, we need first to understand what kind of advice we need to our larger question, that is, why should our institutions invest in creating learning environments that are of a particular kind, configuration, finish or capacity? In campus meetings, it is commonly posited that all that is needed are simple spaces in which to teach, unlike health care facilities. Perhaps learning environments are simply those spaces in which students are present and they will make of them what they will. Such claims ignore the reality that facilities are major investments with consequential effects for considerable periods of time. As Preiser & Vischer (2005) describe the purpose, we need to consider the functioning of current facilities in order:

To improve the quality of decisions made at every phase of the building life cycle, i.e. from strategic planning to programming, design and construction, all the way to facility management and adaptive reuse. . . This means that not only facilities, but also the forces that shape them (organizational, political, economic, social etc.) are taken into account. (pp. 8–9)

Our focus on these issues from an educational perspective is driven, in part, by our renewed interest in progressive and constructivist theories of learning (Dewey, 1933; McLaren, 2007) but also by the increasing demands on educational budgets and processes. With an assumption that learning is not a passive process adequately accommodated in warehouses (or classrooms which are simply considered *people storage units*) and ever more capable technologies of learning and social communication, with growing expectations of knowledge work and recognition of the economic benefits of education, we are forced to consider capital and operational investments in support of learning. While such concerns for the return on investments in workplaces has been extensive in corporations and increasingly in the medical realm, studies of learning environments are fewer and less conclusive.

The starting point for post-occupancy evaluations (POEs) is to identify the purposes for which we collect evidence and hence what evidence should be collected. In evaluation of office environments, in particular, Preiser (2002) identified three types of POEs – indicative, investigative, diagnostic:

- *Indicative* POEs give an indication of major strengths and weaknesses of a particular building's performance. They usually consist of selected interviews with knowledgeable informants, as well as a subsequent walk-through of the facility. The typical outcome is awareness of issues in building performance.
- *Investigative* POEs go into more depth. Objective evaluation criteria either are explicitly stated in the functional programme of a facility or have to be compiled from guidelines, performance standards and published literature on a given building type. The outcome is a thorough understanding of the causes and effects of issues in building performance.
- *Diagnostic* POEs correlate physical environmental measures with subjective occupant response measures. The outcome is usually the creation of new knowledge about aspects of building performance.<sup>1</sup>

The final report of the Australian Learning and Teaching Council project, *A Comprehensive Learning Space Evaluation Model* (Lee & Tan, 2011), identified the field of learning environment evaluation in higher education as immature and noted that evidence is scant. The report also concluded that, because evaluations of learning environments in higher education

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<sup>1</sup>Case study examples of POEs at these three levels can be found in Preiser, Rabinowitz, & White (1988).

were highly contextual, “a single model cannot provide the comprehensive basis for all evaluations” (Lee & Tan, 2011, p. 4). They went further to suggest that:

There are complex evaluation variables such as types and purposes of spaces, degrees and location of ownership, resourcing and scheduling constraints, access to participants, purposes and audiences. In each context, any evaluation model needs to be developed or adapted in order to meet the specific purposes, questions and participants, and resources, involved. (p. 11)

## Evidence in educational contexts

Turning to educational concerns, we can pick up the thread from the earlier section on evidence of physical contexts on behaviours and outcomes. In particular contexts, where needs are clearly defined, the design process can draw upon evidence gained from focused studies of the needs and capacities of particular populations. For example, it is reported that evidence-based design has been used to inform desired spatial attributes in special use spaces, such as in the design of learning spaces for autistic students (Henry, 2011a, 2011b, 2011c, 2011d, 2012; Mostafa, 2008).

In addressing the need for evidence of outcomes in the design of more general learning environments, where the need can be articulated for the delivery of spaces in support of better learning, we find that periodic attempts have been made yet steady progress has not been achieved.

In the United States, for example, efforts in the 1950s were not followed through (Vosko & Hiemstra, 1988). Studies have been undertaken that examine particular experiences, such as the increased student participation noted when a classroom was changed from straight rows of desks facing the teacher to one furnished with soft furnishings in a circular arrangement (Sommer & Olsen, 1988). Evidence of larger scale outcomes of educational facility design, however, remains difficult to gather (Lee & Tan, 2011; Woolner, Hall, Higgins, McCaughey, & Wall, 2007).

Typically, such assessments are of the physical spaces created and the processes by which they were realised – the design and construction processes as, for example, in the Facilities Performance Guide of the California Department of Education (1978). The Higher Education Funding Council for England (HEFCE) *Guide to Post Occupancy Evaluation* (2006) takes this further and identifies three dimensions of a space to evaluate: the process of design and delivery; the functional performance; and its technical performance. It is clear that these dimensions are of interest to the owners and operators of educational institutions but that the metrics do not address the outcome of learning.

Sanoff (2001) extends this in the educational context by placing space as one of the factors that support pedagogical transformation: teachers, students, parents, administrators and designers who, together, create the space and the experience within that space to affect learning. Radcliffe, Wilson, Powell, & Tibbetts (2008) likewise identifies a nexus between pedagogy, technology and the design of the learning space.

As we do in the design of cities, we need also to consider the spaces between (Spooner, 2008). Tanner (2008) takes the approach that schools should be considered holistically, not simply the classrooms in which teaching takes place. Places for formal and informal meetings are essential contributors to learning as much as they are social spaces, for learning is a social process. Thus, the evaluation of learning environments

needs to address a campus wide experience, not only the interior of the classroom.

In general, the findings are that the usual factors (light, temperature, ergonomic comfort, noise) have direct impacts on learning effectiveness. Additional factors, such as the quality of the construction and proportions of space, have been found to have direct impact; higher ceilings create a sense of more space, hence less crowding and greater satisfaction in the quality of the space. Examining four variables (movement and circulation, large group meeting places, day lighting and views, and instructional neighbourhoods), the study identified that design variable have a significant effect on educational outcomes – day lighting, for example, improves learning by 7–18%. Küller & Lindsten (1992) link daylight to health and hence learning through the effect of lighting on cortisol production and hence increased resistance to infection, allowing greater opportunity for and attention to learning.

While we can gain evidence that particular learning environments facilitate learning of particular kinds, for example, good sight lines across a group encourage better discussion (Wong, Sommer, & Cook, 1992), the challenge is greater when we try to create learning spaces for general use (Izzo, Rissing, Anderson, Nasar, & Lissner, 2001) or for more broadly defined outcomes such as those in interprofessional learning.

## A proposed model of evaluation

The nature of evidence in the assessment of effectiveness in design is clearly challenging. We cannot undertake control trials, randomised or not, to tease out relevant factors in the design of buildings. From the review above, we see that some areas of architectural design lend themselves to an evidence approach. Health facilities lend themselves to such an assessment as a context in which observed and measured actions can be associated with a specific range of desired outcomes.

What constitutes evidence in the context of interprofessional learning and how might we implement a system for evaluating learning spaces in this context? Certain task-specific spaces lend themselves to a direct evidence-based assessment; in these, the purpose is clearly defined, the activities traceable and metrics can be devised to differentiate between success and failure. The correlation between the design of spaces and educational outcomes is not closely tied. The evaluation of learning environments differs from issues of patient rooms and operating theatres; the learning process embraces a wide range of factors, tracing a diverse range of inputs and aligning these with a diversity of outcomes. Furthermore, the impact of a design on outcomes can be considered at a number of levels, from primary (or direct outcomes) onwards to more consequential outcomes. An evaluation of learning environments must therefore embrace qualitative aspects of learning, such as meanings, experiences and views of the participants (Ringsted, Hodges, & Scherpbier, 2011).

The qualitative outcomes of design are valued by users and have consequential outcomes yet often difficult to correlate to the design. With a restaurant kitchen, we might be able to track accident rates, food wastage and speed of delivery but can we correlate this to the award of Michelin stars? Is the pleasure of being in a space measurable in this manner and can this pleasure be calibrated to the measured effectiveness? As any visitor to the Louisiana museum in Denmark will have noticed, their appreciation of the Giacometti sculptures is enhanced by approach from above, aligned with the visual proximity to the birch trees viewed through vertical mullions.

Qualitative outcomes of education are well understood and there are accepted techniques for assessing qualitative issues in medical education. The Kirkpatrick model that has been adopted

in the evaluation of medical research (American College of Surgeons, 2011) and also applied in the evaluation of interprofessional education (e.g. Hammick, Freeth, Koppel, Reeves, & Barr, 2007; Pauzé & Reeves, 2010), providing us with a framework to discuss the effectiveness of learning environments in support of learning. The four outcomes of Kirkpatrick's (1996) original model for the evaluation of training programmes consist of:

- (1) Reaction – Customer satisfaction: how well did the learners like the learning process?
- (2) Learning – To what extent did the learners gain knowledge and skills?
- (3) Behaviour – Are the newly learned skills transferred into the work context and applied to the job
- (4) Results – Does the organisation gain any benefit, are there tangible results of the learning process in terms of reduced cost, improved quality, increased production, efficiency, etc.?

In the literature cited above, levels 2 and 4 have been expanded each with two sublevels; in this application, however, it is adequate to retain the original four levels alone. Taking the lead from Hammick et al. (2007), we can adapt this model to the design of learning environments for interprofessional education as follows in Table I:

How might we use this model specifically in the field of interprofessional learning? To illustrate this within the framework above, we might refine the questions in each of the four levels to read:

- (1) Do the learning environments welcome and engage all participants equally? For example, do the spaces privilege the professionals in the process and disadvantage others, such as patients, by differentiating participation or making a group feel unwelcomed? Do the spaces allow for differences in professional cultures (Baxter & Brumfitt, 2008; Hall, 2005)?
- (2) Do the spaces engage the full range of disciplinary knowledge, roles and activities? Do the spaces facilitate particular sets of activities and preclude others? For example, do the furnishings and placement in the room welcome all participants? Would removal of tables change the perceived power relationships between the disciplines represented? Can groups bring their issues into the discussion and learning with the space provided?
- (3) Have the spaces beyond the formal classroom been considered so that the activities outside the room are also supportive of interprofessional learning?
- (4) Has the institution extended interprofessional learning across its campus or is the interprofessional learning facility an isolated outpost in an otherwise hierarchical and exclusionary campus? Is interprofessional learning facilitated elsewhere on campus or is it only occurring inside designated spaces?

Using this model of four levels of interrogation, we can examine the learning experience and outcomes of interprofessional learning in particular learning environments and compare these both across different spaces but also evaluate particular instances for their effectiveness. In particular, this framework spaces the individual learning environment into a context of the institutional support of interprofessional learning, thus reinforcing the understanding that such learning is not an isolated activity.

To illustrate the application of this model, let us consider the Royal Children's Hospital in Melbourne, recently completed and much awarded for its innovations (Bines & Jamieson, 2013). Here, educational facilities have been integrated into the building, both through the assignment of one portion of the building to academic functions (library, lecture theatre, classrooms, simulation ward and student lounge) and the provision of learning spaces in the patient wards. As with most hospitals, it is recognised too that much of the learning occurs in informal spaces, including the corridors, as teams move between patients and tasks.

As the learning spaces in the new facility are being used, observation suggests that different learning is facilitated from that experienced in other hospitals and medical education facilities. The classrooms are located centrally in the hospital, not specifically within one professional area, so that access is afforded to all professionals. Furniture varies in size, shape, height and is moveable, making the claiming of territory and hence professional differentiation less easy. There are simulation wards in the learning area, allowing bedside education to be afforded away from ward assumptions. The student lounge, much resisted when initially proposed, has become central to the learning opportunities for students as it is used by all and allows conversations in which the risk of error or failure are comfortably managed, away from patients or oversight. While corridor learning is still much engaged, the lounge reduces the opportunities for informal hierarchies and dominance. This range of learning environments suggests that the translation of interprofessional knowledge and work practice can be carried readily from learning contexts into practice. As such, it rates well as a facility in support of interprofessional learning.

## Conclusion

The evaluation of learning environments is a complex activity because there cannot be a simple correlation between a space and the learning outcomes for a student. To facilitate the discussion, we have proposed a model based on the Kirkpatrick model for the evaluation of training programmes. This model can be translated into an assessment of spaces for interprofessional learning by focusing on the increasing levels of impact that an environment may have on a learning experience.

Table I. A model to inform the design of learning environments for interprofessional education.

Kirkpatrick Level	Evaluation Training Programmes	Learning Environments Evaluation
1. Reaction	How well did the learners like the learning process?	Do the learners like the Learning Environment which they are using?
2. Learning	What did they learn? (The extent to which the learners gain knowledge and skills)	Do the learning environments facilitate student engagement in the learning or does it frustrate their efforts?
3. Behaviour	What changes in job performance resulted from the learning process? (Capability to perform the newly learned skills while on the job)	Do the learning environments extend and enhance learning through active participation, allowing the learning to be translated into application or behaviours? Do the collective learning environments available to students promote ongoing learning so that it can translate out of the classroom into the surrounding spaces?
4. Results	What are the tangible results of the learning process in terms of reduced cost, improved quality, increased production, efficiency, etc.?	Do the learning environments contribute to improved learning experiences and outcomes for the institution/school?



It should be stated that we are not framing this discussion with an assumption of architectural determinism. Classroom design does not drive student behaviour or learning effectiveness. Conversely, however, it is evident from what has been presented above that poor learning environments detract from learning effectiveness. The goal here is to provide a framework with which to articulate the relationship between space and learning outcome.

The relationship of a person to the space in which they work (or learn) is a complex equation. What is the contribution to learning in the context of all other contributors: nutrition, sleep, culture, domestic context, student experience, technology and, no least, educational content? Schools themselves are systems composed of pedagogical, economic, socio-cultural factors as well as learning environments (Higgins, Hall, Wall, Woolner, & McCaughey, 2005).

Learning is work, of a particular kind. In particular, when we are dealing with adult learners of high motivation working with complex materials that require considerable focus to master, as might be found in a hospital, we can assume that the fewer distractions and discomforts there are, the better the outcome. If there is evidence that productivity is affected by worker satisfaction, we should not be too surprised that the studies indicate that learning is affected by the environment. So, too, do the studies suggest that a single solution cannot be considered effective for all institutions? The design of learning environments must engage and align with pedagogical approaches, institutional mechanisms and generational attitudes of the students (Higgins et al., 2005); thus, a particular classroom design will need to be reassessed periodically.

While a connection may be established between design and learning outcomes with which we might associate thresholds of minimal performance, how far do we go? One meta review, conducted to inform a legal review of educational provision, noted that poor school facilities significantly adversely affected student performance, with comfort, indoor air quality, lighting and acoustic control having the greatest impact (Earthman, 2004). The author recommended, though, that addressing these aspects was necessary only to bring conditions to a level of adequacy. Once the minimal benchmarks have been met, investment should be channelled to other aspects of school operations.

While I discuss here the need to undertake these reviews for the purposes of informing our future design, it is also of interest to our institutions as means to manage investments and provide justifications for capital requests. Of course, this interest goes beyond that of just learning. As we know, any learning environment is also a space for innovation – ask any teacher. Innovation is also the business of research so we cannot disconnect this discussion from that of innovative spaces in our broader work. It can also affect the quality of students recruited, especially in a market where there is competition. The quality of facilities will affect student satisfaction and act as a recruiting feature, just as the green credentials of a university can influence the choices of potential applicants.

It is my postulation that well-designed learning environments can support interprofessional learning through better engagement of better students and reinforce the understanding that better treatment of patients can arise from engaging across professions and roles. With an effective evaluation framework, this postulation can be tested.

## Declaration of interest

The author declares no conflict of interest. The author alone is responsible for the writing and content of this paper.

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