WESLEY IMMS

2. NEW GENERATION LEARNING ENVIRONMENTS

How Can We Find out If What Works Is Working?

INTRODUCTION

This book's introductory chapter discusses the rapidly growing academic conversation occurring around learning environment research. It highlights one significant gap in the literature in this field; the evaluation of such spaces. Its conclusion isn't that little research has been done to document impact, but what has been done has been too particular in focus and method, therefore being limited in its usefulness to practitioners.

This first section of *Snapshots* is concerned with such gaps, and uses emerging research for their identification. Doctoral students bring a fresh perspective to any academic discourse in tandem with knowledge gleaned from recent practices in the field. Their work, consistently serves the purpose of placing a spotlight on omissions within existing knowledge.

In terms of learning environment evaluation, these omissions, understandable as they are given the relative youth of this topic, nevertheless contribute to a disjointed knowledge base concerning the educational impact of learning spaces. It is a disjuncture that is characterised by a preference towards affective issues (how people are responding to such spaces) at the cost of attention to effective issues (what evidence exists to quantify this impact). While these domains address differing aims they are also logically connected. Paucity in one area creates a lack of understanding in the other.

This is not an indictment on past research, rather an acknowledgement of the scale of work yet to be done. The nature of this underdeveloped body of literature is the focus of the initial section of this book. The question to be addressed is what is required of learning environment evaluations; what key issues need to be explored in order to develop a comprehensive, 'catholic', *useable* learning environment evaluation strategy?

The chapters to follow within this section are snapshots of issues that assist in plugging perceived gaps. These insights come from our academic community's brightest minds; post-graduate researchers emerging from extensive experience in school and design settings that question the realities of learning space use and performance.

W. Imms et al. (Eds.), Evaluating Learning Environments, 21–34.

However, first we must frame the context for these emerging scholars' insights – the purpose of this chapter. Initially it questions some assumptions that have arguably limited the scope of past learning environment evaluations. It then argues that evaluation has a mandate to be a central focus in future learning environments research. Thirdly, it summarises a cross section of issues that are emerging through innovative post-graduate research on this topic in Australia and overseas. Finally, it introduces a sample of such research to be explored in the following chapters of this section: Mark Osborne, Lindy Osborne, David Clarke and Chris Bradbeer are leading learning environment practitioners whose expertise in design and education is now being energetically replicated into doctoral research. These authors probe the more complex edges of current research and identify a number of issues of importance that remain unexplored in learning environment evaluation. Their identification of such voids highlights the range of issues learning environments evaluation must encompass.

This first section of *Snapshots* lays the foundation for understanding the scope of what we need to investigate in order to determine if new generation learning environments are actually 'working'.

A HOUSE OF CARDS?

What then are the 'issues' to be addressed in learning environment evaluations? It is wise to first step away from the specifics, and consider how the broad discourse of learning environment research has evolved. Part of this broader perspective is coming to grips with the somewhat patchy evidence-base of evaluations to date.

It is no accident that the title to this introductory chapter contains two assumptions and one question. Inherent to any conversation about emerging issues in research is to first establish a firm foundation of understanding; what do we already know, what is plausible but not yet proved, and what is an issue of merit but presently still conjecture? The title encapsulates these three elements and does so at this early stage of the book so an epistemological stance can be declared.

Such a statement of intent is important. In the mid years of this century's second decade we have witnessed a frenzy of building education infrastructure, the like of which has not been seen since the post-war years. It has been understandable that researchers designers and educators, excited by such rapid development, have been quick to argue a commensurate paradigmatic change in teaching and learning. This discourse has at times surpassed its corroborating evidence. For example, research is often based on a claim that past education was factory-style didactic instruction, where as innovative learning environments now spawn collegial experiential learning. On occasion this creates an almost evangelical passion for 'new pedagogies', which are supposedly either created by or developed for such spaces. For the sake of effectively evaluating impact, these assumptions require repositioning in the light of reality; not because the phenomenon may be untrue, but because without factual evidence we may be constructing new hypotheses on

the back of exciting but unproven assumptions. In short, we may be building a house of cards. We need evidence to accurately articulate the current circumstances that underpin future research, because assumptions make flimsy foundations – once one is disproved, one card removed, all can come tumbling down. For this reason, *Evaluating Learning Environments* begins by stating its position on three critical areas pertinent to learning environments evaluation, and does so using the assumptions and question inherent in this chapter's title.

Do Innovative Learning Environments Actually Exist?

Firstly, the title boldly asserts 'new generation learning environments', assuming that these are a fact. On this we must say we are in agreement; new-age learning environments are a reality. In a physical sense they exist, and do so in growing numbers. Perusal of designs for the annual A4LE Awards (*Association for Learning Environments*) is one indicator. Completed designs submitted for judging are nearly always eye-catching, inspirational, imaginative and exciting. More importantly, they use the latest materials and surface treatments. Their furniture is bespoke or, if not, is well considered to suit a range of users and uses. The designs embed the most recent thinking in terms of sustainability and ICT integration. They exhibit superior building performance in terms of lighting acoustics and airflow. Their designs make effective use of building sites, the potential for community engagement, effective outdoor/indoor treatments, and formal and informal use of spaces. These most recent designs are innovative in that they own features that – in the main – have only recently been embraced by schools and school planners, save for a short period in the mid 1970s. They exhibit qualities that through a lack of imagination or technological development have been absent in most school and classroom designs of previous generations.

Another indicator of the innovative nature of these designs is their capacity to elicit unsolicited attention from an audience extending well beyond educators and designers, into the public domain. With conversations including bold statements such as 'the classroom is dead' ("All in together", 2011) and claims that these designs signify a 'groundswell movement' that will 'radically transform schools' (Knock, 2011, August 2nd), innovative learning spaces are now the type of disruptive intervention that hallmarks significant change in established thinking in education. We applaud the vision of our current generation of school designers and accept that these are, very much, designs that speak to the future.

Do the Design Qualities of New Generation Learning Environments Address the Educational Needs of the Future?

Secondly, in asking "How do we know if what works is working…?" the title assumes these designs are successful in that their plans provide what is needed for the teachers and learners of today and the future. On this assumption we are in

conditional agreement. These design qualities match the theoretical educational needs of what is now frequently termed the '21st century learner'. Characterised this way by the Melbourne Declaration (MYCEETA, 2008) and other influential publications (OECD, 2013), the argument is that today's students must train for a future society and workforce that will demand skills and expertise qualitatively different to that of any preceding generation. The mantra of the mid-2010s is specialist 'knowledge economy' skills that will enable established economies to maintain competitiveness in an emerging Asia-centric knowledge marketplace (Department of Industry, 2013). While a detailed explanation of the characteristics of the '21st century learner' is beyond the scope of this chapter, the implication for innovative learning spaces is that design must facilitate so-called 21st century learning styles. Comments such as those below are common when articulating these qualities:

> Students are experiencing an explosion in information… Its better to teach them to access and process information, than to get them to commit a small percentage to memory…
>
> Teachers must be freely accessible to all and not stay at the front of the room…
>
> Students learn well, even better, from each other…
>
> Spaces must allow students to use peers as fellow learners and teachers, and look to teachers as resources to help that learning…
>
> Classrooms with flexible furniture and moveable walls are needed to allow freedom of movement, access to resources…
>
> Students need individualised learning plans, individualised assessment strategies… spaces that provide the capacity to match a student's knowledge needs to a team of teachers, not just one…
>
> Spaces must reflect that no two students are the same, learn the same.

On matching spaces to such perceived student needs, designers have been quite successful. There is little doubt that new generation learning environments should accommodate multi-modal learning and teaching styles, from the didactic to the highly individualised. They are ICT infused, with multiple ways for teachers and students to use new-age technologies in their teaching and learning. They are flexible in their floor plans, often allowing uninterrupted flow between spaces and free access to key learning areas. They are designed so students and teachers can collaboratively construct learning hubs, specialist groupings, and sites for learning that suit a particular task at a particular time. In short, these spaces have, on paper, removed the teacher from the front of the classroom, the student from the restrictions of classroom learning 'cells', and learning from predominately direct instruction to largely exploratory investigation of concepts. New generation learning environments have turned the focus onto each student's individual need. They are,

as close as a design can achieve, places and spaces that are student focused and facilitate multi-modal, ICT infused, student-directed learning.

However, we must remain mindful that a learning environment is an amalgamation of its physical design and the practices that happen within. They cannot be separated and in this context must be considered an analogous whole, and summarised in the simple formula of design + practice. Profound complexities exist concerning this phenomenon of inhabitation, explored by Bachelard (1994), Foucault (1984) and others, efficiently summarised by the observation the space we occupy has an irrefutable impact on us; "…we make it, it makes us" (Moore, 2012, p. 70). How it is actually occupied is an intractable part of the equation of 'what works', and we cannot assume that a learning environment is 'working' based on its design and the practices it *theoretically* elicits. Likewise, we *can* determine 'what works' if we have a realistic appraisal of what is occurring in its spaces. In other words, a learning environment's practice must be tangible, not aspirational, before any quality evaluation can be planned and implemented.

It is here we strike some difficulty. Arguably, there is little that is historically new occurring in new generation learning environments. The types of practices noted in the dot points above are not new concepts in teaching and learning; they are actually part of a long evolution in educational development. The quotes were retrieved from an archive of 'open classroom' material from the 1970s ("Why we think 1970s Open Education failed", 2014), forty years old but relevant still. Their age starkly demonstrates that in the mid 2010s we are not witnessing any huge change in student needs.

In fact, many of the core needs claimed to be 'unique' to the 21st century were clearly articulated in the Plowden Report exactly fifty years ago (Plowden, 1967). This report built the UKs open plan classroom and teaching strategies on constructivist theories of learning presented by Vgotsky in the 1930s. Dewey's well understood beliefs from the early 1900s about linking education and experience were widely accepted. Dewey's theories spring-boarded off Pestalozzi's 1820s call for a move away from 'formality of instruction through lessons recited in unison, answers to questions based on memorised replies', to a model of schooling that 'stresses the value of activity' and 'education as growth rather than the acquisition of knowledge' (Hilgard, 1996/2004, p. 990). Pestalozzi's theories were, in turn, a development from Rousseau's concept of how education must develop 'active and thinking beings', which were articulated through *Emile* – published in 1762 (Rousseau, 1762/1979).

Thus, the element of doubt we expressed regarding the second assumption in the title does not stem from what it says about today's classroom designs, but from its implied belief that to be successful the practices within these spaces must be as uniquely different as their designs. This runs counter to the reality of how education evolves. The assumption that learners of today have unique and unprecedented needs is only partly sustainable – some ICT practices are one exception. The full gamut of issues that need to be addressed in any evaluation must also embrace theories

and curriculum and pedagogy developments that span more than 250 years. Criteria used to judge these spaces are considerably more complex than simply assessing if the spaces are making students digitally ready for society's next development.

There is scant evidence that in relative terms today's learners' needs are significantly different to previous generations, and there is ample evidence that innovative teaching has always existed (Godhino & Imms, 2011). Thus, our conditional acceptance of this, the second assumption in the title, recognises that new generation learning environments are indeed innovative, the practices within are less obviously so, and this reflects the reality of a slowly evolving educational phenomenon. Thus, if the unit of measurement is the new generation learning environment, the unit of analysis is more complex; this is the sum of the design and *actual* practices within, divided by (or examined within the context of) the potential measurable learning that good teaching can facilitate. The equation should read:

$$\text{NGLE effectiveness} = \frac{\text{Design + practices}}{\text{Aspirations of 21st Century learning/teaching}}$$

Current designs may well be a significant leap from what has come before, but the teaching and learning that occurs within is part of a slowly evolving phenomenon, it is iterative in nature and must be evaluated as such. It would be problematic to link evaluation of new generation learning environment designs to a unique learner concept that is futuristic, undefined, and in many respects blind to historical precedent.

EVALUATION, THE PANACEA FOR WHAT AILS

Can We Actually Evaluate the Impact of Learning Environments?

Having situated *Snapshots* in terms of the two assumptions embedded in this chapter's title, we now turn to its primary question – how do we determine if 'what works' is actually working? Can space be evaluated in terms of its impact on teaching and learning? If history can provide a measured interpretation of what actually constitutes '21st century learning', it also provides sound lessons for the evaluation of learning environments. The following section will determine how far past learning environment evaluation practices can inform those required to assess the impact of the 'new generation' variety.

History teaches us that practices associated with open learning environments have, for decades, constituted one part of a progressive reform agenda in education. For example, Dewey's 1890s laboratory school at the University of Chicago, Neill's social-democratic 1960s Summerhill School in the UK, and Italy's Reggio Emilio early-childhood environmental educational philosophy all utilised spatial manipulation in pursuit of differentiated learning – their versions of what we now summarise as '21st century learning characteristics'. The huge open plan movement

in the UK, USA, Australia and many other countries in the 1970s pursued a similar goal. Each flourished, each faded, and each revisits our consciousness on occasions in the form of a new initiative. Sherman (1990) laments this cyclical nature of education as being a distraction to the point of an illness. Her regret is not so much education's slowness of change, but its seeming incapacity to *sustain* change. That incapacity, she argues, stems from "…pitfalls of bandwagon movements that are born from serious reform efforts but falter with shifts in the political and social climate" (p. 44). Good evaluation, *Evaluating Learning Environments* will argue, is the antidote to the sickness of 'bandwagon' cyclical developments in education. We make the point that sustainability comes from good evaluation practices; if we know 'what works' we can build on past successes rather than be condemned to repeat past failures (Santayana, 1998).

It is sobering to review evidence concerning the 'failure' of the open plan movement. Political factors weighed heavily, predominately centred on 'back to the basic' rhetoric. Figures such as Rickover (1963) argued the USA was falling behind the Soviets in technological development, 'soft' schools were at fault and, as he later famously argued to one hearing, education was too important to be left in the hands of educators (it should be noted that this was on the back of Russia successfully launching a human inhabited satellite before the USA). Similarly in Australia and the UK, a reported fall in literacy and numeracy standards coincided with fear of technologically superior regional neighbours to drive a direct-instruction agenda. Social factors also influenced the demise of open plan classrooms. The western 'cultural revolution' brought about by reaction to the Vietnam War, racial and class activism and civil rights issues, which in part created the environment for open plan schooling, experienced a conservative backlash in the 1980s as economies faltered. This coincided with some negative public opinion about open plan classrooms; children being lost in classroom confusion, directionless in their learning, and teachers incapable of educating collaboratively or monitoring individual progress efficiently (Hunt & Yarusso, 1978).

Perhaps the most sobering lesson from open classrooms' demise was the lack of evidence-based arguments for their closure. Research specific to the impact of learning environments, in particular their effect on student learning outcomes, was rarely cited. While evaluations were available, the quality was poor and, not surprisingly, they were infrequently cited during policy decision-making processes. Without convincing evidence, negative attitudes ruled the day.

In 2009 Hattie published a synthesis of over 800 meta-analyses of educational research relating to achievement. It evaluated findings from hundreds of thousands of educational studies to create a hierarchy of factors with demonstrable effect on student learning. Of the 138 categories he identified, 'open versus traditional' classroom practices was ranked a lowly 133rd with no discernable contribution to improving student achievement. He concluded the practices of multi-age grouping, the use of open classrooms, and team teaching had no significant effect on student

learning outcomes. However, far from putting a final nail the coffin of the importance of spatial design of schools, Hattie's synthesis can be used to identify the principles for their effective evaluation in the 2010s.

Hattie's (2009) synthesis utilised four meta-analyses that addressed the measurement of learning outcomes in 'open versus traditional' scenarios, involving 315 studies with 333 findings. Each meta-analysis 'mined' published studies for claims of effect, and categorised these effects into weighted averages. The synthesis, a meta-analysis of meta-analyses, was inconclusive to the extent no positive effect was found against a benchmark of d = 0.4. Hattie's conclusion that "open classrooms make little difference to student learning" (p. 88) reads as a confirmation that the late 1980s return to traditional classroom design and more formal teaching practices, was justified. They had, at best, the same impact on student development as their alternative. Based on the data at his disposal Hattie's finding was quite accurate. However, systemic flaws inherent to the contributing meta-synthesis suggest the issue of evaluating learning environments' impact on student learning is not the done and dusted deal Hattie's edit might suggest. They highlight four qualities that must be better managed in contemporary evaluations.

The first is that Hattie could not control the quality of the data contained in the 315 studies. These were often questionable; Gray (1978) argued research on this topic was so poorly conceptualised and designed that no useable guidelines for assessing or developing open classroom strategies were possible. He claimed the majority of studies conducted in the 1970s failed to define key concepts, avoided the longitudinal designs required to assess impact beyond an 'initial setting in' time, and regularly used unsatisfactorily small sample sizes (p. 51). Instruments for measuring achievement biased traditional classrooms (Doob, 1974). The meta-analysis methods consistently ignored aspects of the participating studies that should have impacted the final conclusions (Mansfield & Busse, 1977). Differences in definitions, sample sizes, design and analysis resulted in the warning that "…not all studies could be considered as equal" (Marshall, 1981, p. 82), but never the less were used in meta-analyses (Horwitz, 1979). Irregularities in findings of studies indicated poor consistency between measures of 'openness' and outcome variables (Jackson, 1980). While no area of research can boast consistent research quality, 'open program' research from the 1960s and 70s appeared unusually prone to concerns regarding research design. When evaluating learning environments we must maintain consistent high-quality design across learning spaces evaluation, and core to this is ensuring the provenance of assumptions core to any evaluation.

The second issue concerns the age of the data. The four meta-analyses were conducted between 1980 and 1982. Hattie's edict that open classrooms had no effect must be considered in light of concerns about the quality of research at that time, and the fact that this conclusion was based on data over 35 years old. Even assuming the 333 studies were scholarly, a finding of 'no effect' in the 1970s cannot be used to plausibly claim a similar trend exists in the 2010s. This is particularly problematic when one considers the types of practices characteristic of 'open

programs' such as team learning, activity-based, self-directed learning, are all well embedded in primary or elementary classrooms of the 2010s. Clearly, these were practices that did 'have an effect'. The second issue, then, is that evaluation data must be relevant to contemporary situations.

The third issue is that clear definitions of key concepts are mandatory. What is being measured in these 333 studies is the third issue. Hattie's defining category is 'open versus traditional'; it goes no further, but suggests in-text that this refers to 'programs' (p. 88). Defining an 'open program' proved problematic in the 1970s with studies "…not all hav[ing] used the same measure of openness…" (McPartland & Epstein, 1978, p. 133). A criticism made of key meta analyses at the time (for example Glass, 1976; Peterson, 1980), this point is made consistently by Horwitz (1979), Jackson (1980), and Marshall (1981) who each tempered their findings with cautions about assuming the term was used consistently across all, or even some, studies. Ironically even McPartland and Epstein's study that explicitly intended to address this anomaly by testing for differences between 'open' and didactic instruction using a large sample (N = 6,225) fell victim to poor stipulative definitions. Only one of their seven items used to identify the program type was unambiguously characteristic ("In class the teacher stands at the front and addresses the class as a whole") (p. 143). The remaining six could equally have applied to didactic or open learning/teaching styles. To further confuse this research, 'Open programs', however, were often taught in both traditional and open-plan classrooms (Gray, 1978).

The fourth issue concerns how 'effect' is determined, or in other words, what counts and what does not count'? Hattie bases his edict on studies that produce a measurable effect. While understandable, this produces a finding based on limited data, what McPartland and Epstein (1977) refer to as a "batting average of successes and failures" (p. 133). An example of how this proves problematic is contained in a USA summary of over 30 'open program' evaluation studies (Educational Research Service, 1974) that included the variables and findings briefly summarised in Table 1.

The variables being addressed are insightful and informative. It is not a meta-analysis in the true sense as effects were not categorised and calculated to achieve weighted averages. It is possible that some may be represented amongst the 333 in the four meta-analyses used by Hattie but there is no method to verify this. What is problematic is that findings were used despite researchers (Gray, 1978) and even the authors of the actual meta-analyses used by Hattie cautioning the reader of the veracity of their data (Marshall, 1980; Horwiz, 1979). In the process informative findings were excluded because they did not report an empirical effect. A message from this, is that even the most methodologically rigorous approaches have drawbacks that impact on the legitimacy of findings. The fourth issue then, is that there is no such thing as purity of data. Good learning environment evaluations can and should be based on rigourous and quality benchmarking, but should also be considered legitimate if otherwise non-compliant data passes a 'reasonable assumption' judgement.

Table 1. Summary of studies, Research on open education (Educational Research Service, 1974)

Variables	*#*	*Findings*
Student achievement	7	Two significant findings favourable of open programs in primary schools, one statistically insignificant finding. High school studies found one favourable of open programs, two statistically insignificant. Researchers cautioned that the measurement tools favoured students in 'traditional' settings.
Student self-concept	3	One study found students in open programs had higher measures of self-esteem. Two studies produced statistically insignificant findings. Boys' self-esteem was significantly higher in open programs.
Student behaviour	3	Open programs produced higher levels of student academic confidence, greater intellectual independence, better use of time, fewer incidents of disruptive behaviour.
Student attitude	5	Four studies found statistically significant findings on student attitude favourable to open programs, one study the reverse. Boys' attitudes to learning were improved in open programs.
Transition (OP to trad)	1	Students from a primary school open program found transition to high school easier that traditional program peers.
Teacher opinion and morale	6	Of two high school studies of teacher opinion and morale, one was in favour of open programs, one the opposite. Of primary teachers, one found morale lower in open programs. A study of inexperienced teachers was favourable to open programs. Teachers in small, informal open program 'teaching teams' were more satisfied than colleagues in large teams. No one personality 'type' suited open program teaching.
Parent and community reaction	4	Three studies were favourable to open programs, one showed no significant result. A 'community and police opinion' study was in favour of open programs.
Administration roles	2	One study found a need to free Principals from administration in order to focus on in-service training and leadership.
School costs	1	Open program schools allowed for increased enrolment capacity, a more diversified program, and increased floor space for instructional use.

This section has briefly explored past research to determine what lessons history teaches us about good learning environments evaluation. It makes the point that much that has been done in the past has been of dubious quality, and has led to sometimes erroneous conclusions, highlighted in particular by Hattie's definitive statement about provable impact of classroom design. The core message is that if education is indeed doomed to cyclical bandwagons, *quality* evaluation is the

panacea that will ensure learning environment designs are not just another fad. But this must be based on sound evidence. Upcoming learning environments evaluations must maintain a high standard of research, must ensure data is relevant to current developments, must maintain consistent definitions of key concepts across all evaluations, and must ensure a balanced choice of what data is deemed 'of use'.

FRAMING THE 'ISSUES' RELEVANT TO LEARNING ENVIRONMENT EVALUATIONS

There exists a suite of issues surrounding the concept of *change.* Learning environment evaluations need to address issues of behavioural change, in particular the ways we can measure teacher use of NGLS with the aim of improving uptake of the affordances of these spaces. Of a similar ilk, evaluations need to address issues of change management, in particular identifying the qualities of school leadership that generate sustainable effective practices in NGLS. Is it possible to develop an evidence base that helps to predict the most effective strategies for school principals and management teams to effect sustainable improvement in the use of these spaces?

There exists a suite of issues surrounding the concept of *design*. How do we utilise evaluation to ensure the design of NGLS will meet the learning needs of so-called '21st century learners'? How do we evaluate building performance, in particular, acoustical qualities, air quality, lighting quality, pedestrian 'flow', and how these effect learning and teacher/student 'inhabitation' of NGLS? What is the affect and effect of furniture and other 'situated' artefacts within a learning environment? What role can school design/implementation professionals play in assisting the effective 'inhabitation' of ILEs, beyond post-occupancy?

Many issues also surround the concept of *pedagogy and curriculum*. What constitutes 'innovative' in terms of spaces and pedagogy? Without guiding principles, evaluations run the risk of comparing apples with oranges. Evaluation must provide us with robust frameworks for structuring any analysis of the educational impact of space. What do NGLS enable in terms of ubiquitous ICT usage, and what is the impact of such approaches? What are the best approaches to collaborative teaching in ILEs? How can teachers manipulate or 'curate' learning spaces for desired learning outcomes? How do teachers respond to formalised and informal curriculum in NGLS configurations, and in particular what spatial qualities might motivate, hinder, or facilitate teachers' attempts to achieve deep learning outcomes with their students? How can NGLS make curriculum, or even teachers' pedagogies inclusive for those with learning and physical disadvantages?

There exists a suite of issues surrounding the concept of *measurement*. How do we isolate the variables identified in the previous paragraphs within a schooling situation that has steadfastly resisted empirical evidence? It is generally accepted that the mass of confounding variables existent in the complex world of a schooling environment makes even quasi-experimental approaches to evaluation problematic.

It is just these types of data that are required however, if we are to make a balanced judgement about 'what works'. Measurement may be the most critical issue facing learning environments research. As the earlier conversation concerning Hattie's (2009) synthesis of meta-analyses pondered, the quality and range of learning environment evaluations is constricted by what counts for valid data and how these are used.

The above is not an exhaustive list. It highlights how complex the phenomenon of learning environments has become in recent years. Attempting to make sense of one aspect of this growing field – evaluation – is the purpose of *Evaluating Learning Environments*. This chapter began by unpacking some assumptions rife in learning environment development, with the purpose of situating *Evaluating Learning Environments* epistemologically in what has come before. It argued that we are destined to revisit past successes and failures unless we learn from history and build on evidence of good practice. Where this quality evidence does not exist we must develop robust bodies of knowledge to ensure any future outcomes are judged on fact, as opposed to conjecture and popular sentiment. It made the case that sound evaluation was the key to sustainable learning environment development, and that the issues that constitute what is required are wide ranging and complex.

The following four chapters are snapshots of what is required in the coming years, examples of the 'emerging issues' in learning environment evaluation. David Clarke explores the exciting phenomenon of the architect as an active agent in the inhabitation of NGLS. By inhabitation I refer to the extension of 'occupation'; what happens over time, as compared to simply moving in. Habitués actively and consciously manipulate their environment to pursue a set of scholastic and personal needs that often have little to do with what was planned (Imms, 2015). The architect, argues Clarke, with her/his knowledge of the design process and the nuances of living within a space, has a great deal to offer learning environment evaluation of how people live within the spaces they designed. Chris Bradbeer explores the issue of teacher collaboration, not as a product of a particular NGLS design but as a precursor and driver of that design. His example is the antithesis of what occurred in the 1970s where teachers were 'parachuted' into innovative learning spaces with little consideration given to what they might actually do, and what support they required. Mark Osborne writes of his emerging research into change management, of the structures and process that can be borrowed from other disciplines to assist leaders as they move often large school populations into new and challenging learning environments. Lindy Osborne explores change from the perspective of the training institution. How should a large and well established body of practice like a university modify and re-invent itself based on evidence of effective practices elsewhere? Embedded in this evaluative approach are, we suspect, answers to questions currently being raised by school departments and ministries of education: what is required to change the mindsets of educators to make the most of the affordances offered by NGLS?

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