The impact of new learning spaces on teaching practice

Literature Review

College of Business

Contents

Introduction

Embedded in RMIT's Strategic Plan 2011-2015, *Transforming the Future* (2010) is the goal to "create a world-class learning environment for students by offering opportunities for collaboration, team work, a sense of belonging, a creative culture and opportunities to excel…"

Thody (2008) defines university learning spaces as 'learning landscapes' that broadly encompass "… conceptually holistic, loosely-coupled interconnections of all formal and informal, on- and off-campus, virtual and physical facilities, sites and services" (p. 2) The spaces in which we work, live and learn can have profound effects on how we feel, how we behave, how we perform.

In 2012 RMIT University's College of Business executed an ambitious transition to a new building. In late 2011 ADG professional staff found themselves in uncharted waters when charged with the planning of professional development activity to support academic and teaching staff in their move to a new learning and teaching landscape. It was expected that:

> The potential of new spaces will be maximised with the adoption of new paradigms of learning and teaching that transition from teacher-transferred 'information giving' to student-centred 'active learning' experiences that encourage students to collaborate with their peers to construct new knowledge. (New Generation Learning Spaces for RMIT: A College of Business perspective, 2011, p. 4)

The literature review that follows was conducted in the Academic Development Group (ADG) as they sought to explore the impact of learning spaces on teaching practice in order to better understand the effects of innovative learning space design and technology change.

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Context

RMIT's Swanston Academic Building (SAB) is a state of the art learning and teaching facility occupied by the College of Business and available for use by all RMIT colleges. Key features of the innovative 11 level building include: 12 lecture theatres, 64 teaching spaces, 10 specialist learning venues, cantilevered student portals with landscaped indoor gardens and an innovative blend of teaching and office space on all levels. Greywater recycling, solar hot water, sunshadows and natural ventilation system contribute to the building's environmental sustainability principles.

New learning spaces are arenas for innovative teaching practices that are not easily implemented in more traditional classrooms. The SAB's project and interactive learning spaces with capacities between 30 and 60 include circular or triangular 'pods' in a space with no clearly defined 'front', where students face different directions and where whiteboards and projection screens are situated around the space. Tiered interactive lecture theatres with two rows of seats per level facilitate collaborative activity by enabling students to swivel to form pairs or groups with those behind them. The discursive theatre facilitates Socratic style debates with a high level of interaction through discussion. Conversational spaces furnished with stools and small coffee tables are especially suited to small group work, discussion and brainstorming. Lectorial spaces accommodating between 60 to 120 students offer opportunities for groups of students to experience both teacher-guided and collaborative work with peers in a single session. These spaces have replaced classrooms in which students occupy a physically subordinate space, in which a teachers' station separates the conveyer and the receivers of knowledge.

Design ideas for the SAB learning spaces were informed by data collected in focus groups and interviews with academic and teaching staff. Information was obtained about the vision of the changing relationship between teacher and student, student and content and student and student. Staff overwhelmingly identified their interest in flexible student-centred spaces supported by state of the art technology.

Purpose

The following page provides information about the adoption of educational technologies associated with teaching in new learning spaces and examines the extent to which new learning spaces and associated technology are an incentive for teachers to adjust their practice to stimulate and enhance student engagement. The research provides evidence of what teachers actually do when working in new teaching and learning spaces; in particular innovative spaces, some of which are on a large scale, and often technologically driven. The literature review identifies:

- empirical connections between new learning spaces and teacher practice
- evolving pedagogical and academic development needs
- gaps in existing research
- lessons learned from case studies

Review method and theoretical perspective

A range of publications was reviewed, including research papers, conference proceedings, websites, newspapers and literature reviews that addressed connections between innovative learning spaces and pedagogical practice. The studies used a range of methods including survey data, observations, interviews, focus groups, and case studies.

Survey data focused to a greater extent on student perceptions of the impact of space on their behaviour and less on teacher behaviour post-use. Case studies, while recommending further research, tended toward design descriptions of new spaces and less about what was done in the spaces. Only a small number of studies were conducted on large-scale spaces. Significantly, many of these studies were post-occupancy. There were few longitudinal studies that tracked teacher perceptions and feedback throughout a more holistic process of innovation.

Integration of Information Communications Technology (ICT)

The use of new ICTs requires teachers to consider how the new setting will enhance the student learning experience (Jamieson, Fisher, Gilding, Taylor, and Trevitt, 2000). Historically, the introduction of new technology to support new learning environments has faced barriers due to inadequate training and teacher apprehension about potential implementation problems (Boethel and Dimmock, 2005). Cuban's (2001) study exploring the use of new technologies in schools in Silicon Valley, found that most teachers regardless of the availability of technological equipment made few changes to their teaching practice, typically sustaining rather than altering them. Ramaley and Zia (2005) cite one study where despite the fact that 99% of K-12 schools have Internet access, interactive technology-enhanced resources are rarely used effectively. Despite challenges related to the adoption of technology, when implemented effectively technology is seen to be "a key enabler of change" (Jamieson, Roberts and Wakefield, 2009, p. 7). The design of innovative learning spaces is necessarily connected to the need to integrate various kinds of technologies within these spaces with the aim of enabling change. In educational environments this creates new possibilities. New teaching practices are required to achieve desirable teaching and learning outcomes.

The constructive implementation of ICT in learning spaces has been demonstrated to support the needs and expectations of the Net Generation (Brown, 2005). Kibby (2012) predicts that within three years, campuses will be completely digital. The challenge is to facilitate the use of mobile devices both in transition spaces such as in internet cafes, (Cilesiz, 2009) and combined with other technology in new learning spaces, and places where educational interactions can be harnessed to foster collaborative learning, team work and creativity.

Technology is always in transition. In particular, the Internet has changed the way we perceive spaces as not just physical but also incorporating the virtual (Oblinger, 2005). For educational environments, learning spaces are no longer just classrooms but anywhere a student can access a computer, laptop, i-pad, or i-phone. Due to the mobility of this technology, effective communication can be conducted between home, work, campus, and other spaces. Today's students perceive this synthesis of work and learning as the norm. It is not uncommon to observe multi-tasking using mobile communication systems – telephone, e-mail and texting. Jamieson et al (2009) notes that the most recent generation
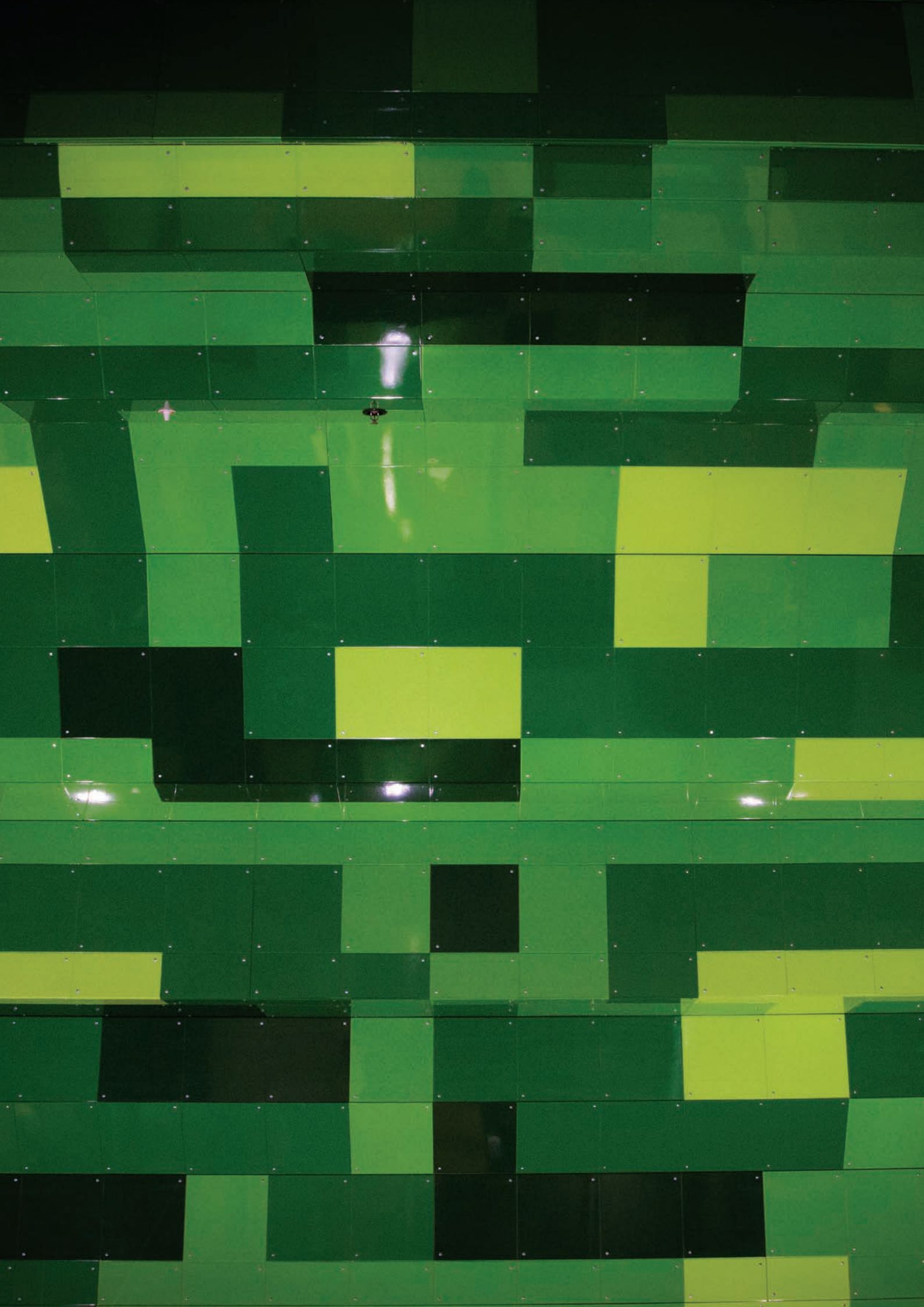
of students, the Net Generation, are also employed or need to commute to university, which potentially limits the time that they devote to their studies. The use of ICT therefore facilitates the constant connection to learning resources.

Much of the most recent literature reflects the need to incorporate technology in its various forms within learning spaces. The inclusion of ICTs in such environments results in challenges as well as benefits. On the one hand, there is a need to reimagine teaching practice and to rethink the role of the teacher, while on the other new possibilities "exist to engage and motivate students" (Blackmore et al., 2011, p. 26). Prensky (2001) believes that "...the single biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language, (that of the pre-digital age) are struggling to teach a population that speaks an entirely new language" (p. 2).

Temporal Framework

Bruckner (1997) identifies the concept of temporality as a significant feature in how organizations, teachers and students react to new learning spaces. Blackmore et al. (2011) identify a conceptual framework of four temporal stages connected to the adaptation and use of new learning spaces: 1) Design, 2) Implementation and Transition, 3) Consolidation and 4) Sustainability/re-evaluation phase. Key points of the first three phases relevant to the transition to the SAB are summarised and presented.

Design Phase

Wilson (2008) describes this phase as "the process of understanding the intersection of pedagogy, space and technology and the implications to the enabling of learning" (p. 19). The design phase also describes the period of design and resource consultation of all stakeholders such as architects, builders, practitioners, first generation users in preparation for change. In this phase stakeholders consider the anticipated impacts of the design process.

Design elements are based on the notion that redesigned spaces create desirable and improved teaching conditions, enhance pedagogies and subsequently impact students' well-being and learning (Oblinger, 2006).

Blackmore et al. (2011) state that "the focus of the design phase literature is on [the] built environment and space oriented to perceived student needs rather than on teachers..." (p. 6). Much of the literature assumes that new learning space design will prompt changes in teaching and learning without necessarily addressing teaching needs. There is an emerging suggestion in the literature, that "a participatory or 'generative design' process will improve teacher practices which in turn will benefit students' learning experiences" (p. 8)

Jamieson, Dane and Lippman, (2005), Dane (2004), and others advocate involving end-users in the pre-design of 'educational spaces' in order to consider their respective needs. During this phase it is vital to include feedback from teachers (Higgins, Hall, Woolner and McCaughey, 2005; Temple, 2008) as teacher morale, attitudes and behaviours can affect how spaces are used.

Implementation and transition phase

The transition from old to new environments is described as a 'finished beginning' when new spaces are complete, handed over and finally occupied by all users. (Barrett and Zhang, 2009, p. 4) This phase can range from months to years depending whether staff and students occupy completed spaces en-masse or are phased in over time (Blackmore et al., 2011).

Some evidence suggests that new spaces may have a positive impact on teacher and student perceptions (Darling and Hammond, 2002). Bullock (2007) suggests that there is a positive correlation between new (or renovated) spaces and student learning.

The implementation and transition phase presents a range of critical issues to consider which Blackmore et al. (2011) discuss, including: security and access, changing perceptions, adaptation, managing transition, school and class size, learning communities, curriculum, school culture, scheduling and facilitation of group work (pp. 9-10).

During this phase the provision of flexible facilities in new spaces anticipates that teachers will modify their teaching strategies. It is important for teachers to be encouraged to identify with and adapt to the new spaces, to develop the learning environment for specific purposes as well and to re-imagine their own teaching practice.

Consolidation phase

"Consolidation is what happens in practice as buildings are used by teachers and students for the purposes of teaching and learning" (Blackmore et al., 2011, p. 21). It is unclear from the research literature whether specific teacher practices change or become long-standing during this phase as little information has been found that describes how new spaces are used by teachers. Many of the studies that focus on post-occupancy evaluations of physical attributes of new spaces obtain feedback from architects. Among the complex variables that should be taken into consideration when attempting to identify what actually happens in practice over time during this phase include teacher practice, the design of learning experiences, the extent of student engagement and aspects of the spaces themselves.

Combined phases

Throughout the temporal phases for new learning spaces it is critical to consult with and harness the knowledge and perspectives of all key stakeholders, in particular, students, ICT representatives, and academic teachers in order to increase the chances of desired outcomes. First, in support of this rationale, students as digital natives (Prensky, 2001) are more likely to appreciate the potential of technology. Second, ICT representatives help to ensure that new designs of learning spaces are well informed by current and future ICT capabilities. Third, and importantly, the role of the academic teacher is to frame course context, to determine how it will be accessed by learners and to recommend assessment frameworks. Thus, an academic's role will be to clearly outline to students how they will use the spaces with the aim of creating an innovative, integrated and collaborative learning environment (Jamieson et al., 2009).

Identifying the gaps

Steel and Andrews (2011) identified an imbalance in the research literature with most situated in the design phase, a little in the transition phase, more on the consolidation in practice phase and very little on evaluation and sustainability matters. Examining the literature within the conceptual framework of these four overlapping phases, Blackmore et al. (2011) found the following gaps in the research in each phase they investigated.

In the literature associated with the design phase:

- a lack of recognition of the the importance of individual school contexts and a scant use of data that can be replicated such as interview feedback from teachers and students as key sources (Blackmore et al., 2011, p. 11)

In the implementation and transition phase literature:

- little empirical research that explores how new relationships and arrangements are negotiated and formed by teachers and students in the process of actually using new learning spaces, (Jamieson, et al, 2000)

- a lack of exploration of relationships between the use and meaning of learning spaces and student academic outcomes

- gaps in the identification of the need for professional development programs to prepare teacher's for use of new learning spaces

- inadequate acknowledgement of the affective aspects of teacher and student anxiety (Leithwood and Beatty, 2008) and the need to develop a safe environment for teachers' emotional needs to promote teaching effectiveness (Blackmore et al. 2011, p. 19).

Few studies on the consolidation phase examined pedagogical change or teacher professional development. Those that did exist were generalised using combined outcomes. Blackmore et al. (2011 pp. 19-20) found research lacking in a number of areas. In discussion of connections between pedagogical issues and new learning spaces gaps were noted in relation to:

- teachers' and students' attitudes, practices, and outcomes

- key determinants that can foster changes in pedagogical repertoires

- the extent to which teachers use new technology or shape flexible space for themselves pedagogically

- the impact of innovative design on new ways of teaching and learning and which spaces or combinations work in terms of effective practice

- the long term benefits of creating a sense of ownership of built environments by teachers and students (pp. 32-33)

The gaps identified in the literature have a common thread throughout each phase: the paucity of research about the impact on teacher practice of technology-enriched innovative learning spaces and the fact that few recent writers on long-term ongoing effects of such spaces and their sustainability. There appear to be considerably more gaps for the consolidation phase, especially within large-scale new learning spaces. Most of the literature, regardless of focus, describes smaller-scale contexts than the SAB learning spaces and many investigate primary and high school environments rather than tertiary learning spaces.

Learning spaces and teacher practice

Research on the effects of new learning spaces on teacher practice has primarily focused on tangible aspects of environmental impact such as spatial density, light, noise, temperature, ventilation and air quality, rather than the intangible aspects of the ways both teachers and learners react, respond and use the spaces to enhance and optimise teaching and learning experiences.

The SAB space design and layout lend themselves to pedagogy which is primarily collaborative. In some spaces technology is utilised extensively. The design of project spaces, for instance, is unique, using specifically designed collaborative software linked to 5 pods of 6 computers, each with their own color-coded wall monitor and control panels. While teachers may embrace more traditional pedagogy, the space allows for the use of technology to enhance the learning experience. The use of this and other new spaces for collaborative learning raises a number of challenges:

» Class management: How might teachers monitor each group activity, manage noise levels, participation or group management?

» Curriculum: What effect does the new space have on curriculum or lesson design? The content may not change but activities may need to be adapted to take advantage of the new technology.

» Teaching Schedules: Teachers may want to understand the benefits of breaking up blocks of teacher-directed delivery, traditionally defined in two- or three-hour blocks, to enhance effective learning.

» Pedagogy: To help teachers conceptualise their own pedagogical vision of innovative and technology-enriched spaces, Steel & Andrews (2012) suggest that teachers explore how others have used such spaces in order to learn from creative models and to test their own new ideas in a safe supportive environment.

Fisher (2002) questioned why the physical environment is largely ignored by teachers as an important influence on learning. Some European, UK and Australian studies, have attempted to identify more about what actually happens in learning spaces, while acknowledging complex and indirect links between learning spaces and outcomes. Fisher (2005) explored pedagogy and environment performance measures to help relate pedagogy, including student and teacher attitudes, to space.

In the field of environmental psychology, Gifford (2002) noted that within educational settings, the "amount and arrangement of space is very important for classroom performance and related behaviours" (p. 298). He notes that open learning spaces can have positive outcomes when teaching strategies are matched to the space.

Dudek (2000) provides evidence of links between space, pedagogy and outcomes in a comprehensive design guide on school architecture. In addition to highly technical details and educational theories, the guide encompasses functional requirements of spaces and the impact of curricula on design. There is no focus on teacher practice. Dudek includes case study examples of K-12 modern school settings in UK, USA, Canada.

North Carolina State University, the University of Colorado at Boulder and Harvard University have introduced teaching in small classes where interactive, collaborative, and student-centred learning is encouraged (Rimer, 2009).

Lee and Tan (2011) conducted a comprehensive review of the literature to examine existing approaches to evaluation of new learning spaces in educational institutions. Although they found limited empirical evidence of such evaluations, much of their work reviewed factors advocating the approach, design and need for new learning spaces as well as reports on case studies.

Brooks (2011) identified some of the few projects that have yielded empirical results regarding the effects of learning spaces on teaching and learning. A project undertaken in the Physics Department at Massachusetts Institute of Technology (MIT), replaced traditional large lecture theatres with smaller high-tech classrooms and introduced a new model of learning and teaching called TEAL (Technology Enhanced Active Learning) for a first year physics course, emphasizing a hands-on approach in reconfigured space. Brooks also identified North Carolina State University's Student-Centered Activities for Large Enrolment Undergraduate Programs (SCALE-UP) space was redesigned to change how introductory calculus-based physics courses were taught. The University of Minnesota's Active Learning Classrooms (ALC) were used as a pilot study to research the impact of teaching and learning spaces on teaching and learning. The ALCs were modelled on TEAL and SCALE-UP rooms (Brooks, 2011). These examples of space redesign, (round tables, networked computers and laboratory equipment) reportedly helped to change teachers' pedagogical approaches resulting in positive teacher-student interaction and increased collaborative learning and problem-solving for students. However Brooks noted that the reports of both the TEAL and SCALE-UP projects suffered from methodological issues, so it is unclear whether results "are due to course or classroom redesign or both" (p. 271).

Although a considerable amount has been written on the subject of learning spaces in general, there is little systematic, empirical research addressing the impact spaces have on how teachers teach and how students learn in them (Brooks, 2011). Overall, much of the literature focuses on the conditions and design of learning spaces and not on the outcomes of how those spaces are used, in particular, by teachers. The Price Waterhouse Research Report (2003) reviewed over 900 UK public schools and evaluated building performance tangibles (e.g. light, temperature, building condition) and student outcomes. The review contained no assessment of the impact on teacher practice.

Pedagogical adaptation

Although it is reasonable to assume that teachers aim to facilitate a quality learning experience for their students, for some, barriers still exist that impede adaptation and change. Introducing a change to existing practice for new technological skills, is commonly viewed as difficult (Boethel and Dimock, 1999). To what extent do teachers change their teaching practice in the face of changing environments? The following studies focus on issues connected to pedagogical adaptation within tertiary environments.

The Department of Education and Early Childhood Development (2009) conducted action research with 162 schools to examine the ways in which these schools have used resources for time, space and ICT to change teacher practice. Leading practices that have been adopted by schools and teachers are identified. An underlying premise advocates that the design of new learning spaces should promote and enable collaboration between teachers in order to learn and apply new skills together. The study acknowledges that the affective aspects such as the capabilities and self-confidence of teachers should be central considerations when dealing with technological and cultural change.

Sztejnberg and Finch (2006) conducted an observational study of 10 secondary schools in Poland. They identified how trainee teachers used and adapted space by having them first record spatial maps of classrooms and second, respond to two questionnaires to identify teachers' teaching styles and evaluate physical properties of classrooms. Results suggest that wherever traditional seating in rows and columns are the norm then so do teacher-centred styles.

Lippincott (2009) found increased overall satisfaction among students who experienced new and renovated spaces such as those boasting smart classrooms, wireless networking, up to date technology and multimedia labs. It was unclear if the new buildings themselves resulted in improved satisfaction or if enhanced pedagogical practices were factors.

Walker, Brooks and Baepler (2011) found that student learning improved when instructors adapted their pedagogical approach to new space by intentionally incorporating more active, student-centred teaching techniques. However, Thomson (2009) found that when faced with new technologies and challenges, teachers need to be well-prepared as well as supported and encouraged to take risks. Otherwise, "...they may revert to 'default pedagogies' or 'the way we used to do things' rather than explore innovative pedagogies" (cited in Blackmore et al., 2011, p.15).

Elements of both adaptation and resistance were identified by Hunley and Schaller (2006) who used focus groups and interviews, surveys and photographic studies to explore the use and adaptation to three new learning spaces at the University of Dayton. In addition to data that showed "no one physical structure accommodated all types of learning" (p. 13.9), results found that teachers who like leading discussions or small group activities prefer flexible space with movable furniture and seamless technology. Those who were not comfortable with a range of approaches tended to alter new spaces to create a more traditional lecture-room effect (Hunley and Schaller, 2006).

Pedagogical adaptation often involves pedagogical collaboration. A number of studies show that when spaces and curriculum are specifically designed and aimed at collaborative planning, teaching and learning, collaboration increases with the caveat that implementing successful classroom group work, for example, depends on learners being adequately trained in group-work skills (Blatchford et al., 2006). A senior public school case study by Gislasen (2009) found that open plan spaces facilitated collaborative, multidisciplinary teaching practices.

Wolff (2003) conducted a systematic analysis of Community Colleges in the USA to determine how physical environments can support and encourage collaborative, project-based learning. He found that while it was difficult to pinpoint what worked successfully the interrelationship between the design elements helped to promote collaboration.

Teacher challenges and constraints

Teachers can experience recurring complex challenges and pedagogical constraints when confronted with innovative learning spaces along with embedded technology. Steel and Andrews (2011) identified six issues that should be addressed in order to support teachers to re-imagine their teaching practice.

» **Pedagogical and technology-related beliefs** – Teachers' underlying belief systems can represent differing and sometimes conflicting interests, beliefs and values which therefore need to be made explicit and coherent regarding pedagogy and the value, use and role of technologies. How teachers conceptualize these complex and differing beliefs can dramatically influence teaching practice in new learning spaces.

» **Pedagogical image for use of ICT** – Many teachers are unfamiliar with how technology-enriched spaces can be optimally used. Some learners may know more than the teachers about new technology. Thus there is a need for teachers to have time and frameworks to develop an individual pedagogical image relevant to ICT. This will enable them to make known to students how the use of new spaces is relevant to their learning and to make any pedagogical changes.

» **Technologies and space** – Teachers who may not have used or experienced current technologies and/or innovative spaces, may have difficulty identifying the 'affordances', i.e. positive features of spaces that offer potential for action, and 'constraints', i.e. among these features the conditions and relationships offering structure and guidance for action (Kennewell, 2001). In their study of the Advanced Concept Teaching Space (ACTS) at the University of Queensland, Andrews and du Toit (2010) identified anxiety about technology-related issues during teaching time as the most limiting factor for 60% of respondents.

» **Curriculum agendas** - Because teachers are inclined to transfer their existing methodologies and practices of their respective disciplines to new spaces (Kirkup and Kirkwood, 2005), translating curriculum to blended online models, for instance, can be fundamentally problematic.

» **Student diversity** – Preparing adequate curriculum to address the wide diversity of learner needs and characteristics is a challenge for all teachers. Students' ability to develop digital literacy is a critical aspect of new learning spaces. "Overlooking this can result in poor student learning outcomes in these new spaces" (Kennedy et al., 2009).

» **Pedagogical design and contexts** – The pedagogical context incorporates complex variables connected to learning and teaching and the relationships between an environment and those within it. While one teacher's learning design may fit their own pedagogical context; it may be unsuitable for another. The challenge for teachers is to use learning designs efficiently and effectively in new spaces. Steel and Andrews note one caveat: after implementing effective teaching and learning strategies, teachers' workloads may increase, which may lead to demotivation to continue to improve.

Academic development for new learning spaces

The primary role of academic developers has largely been focussed on improving teaching practice in order to more effectively address learning outcomes, while the role of non-academic personnel has related more to physical and technical design and facilities. Jamieson (2003) argues that at a time of significant transition in higher education, the design and development of suitable new learning environments should take priority for academic developers.

Many articles, for example, Dane (2004), Jamieson et al (2005), Radcliffe, (2008) and Lippincott (2006) advocate the importance and benefits of conducting evaluations at both pre-design and post-occupancy, in particular to involve stakeholders and end-users who can provide feedback on use, problems, and future needs.

To date, there appears to be few guidelines or opportunities for academic development activities and approaches that support teacher practices in new learning spaces. There is a risk that various perspectives on the complexities of changing pedagogical practices may be overlooked, particularly the perspectives associated with leadership, academic development and teacher diversity. Acknowledging this gap, Steel and Andrews (2011) present issues for academic development that need to be considered to achieve desirable changes in teaching practice. Issues include the need:

- to accommodate individual teaching beliefs when asking teachers to consider reviewing and adapting their practice

- to provide opportunities and time for teachers to resolve, re-conceptualise and reflect on their pedagogical vision and beliefs and identify the affordances and constraints

- for academic developers to build up and draw on "a 'toolkit' of theories, strategies, techniques, ideas, values and experiences in order to respond to the varying contexts they work within" (p.3).

- for teachers to be supported and motivated to implement change (e.g. by peer review and building leadership) as they think of new ways of using spaces

- to improve ICT skills among teachers to lessen digital gaps in higher education

Other studies raise further issues, including the need:

- for teachers to propel new spaces; be convinced as to see reasons why they should make any changes and be motivated to use and keep using spaces to ensure sustainability (Reuschle, Kissell, Fryer and King, 2008)

- for distributive leadership, i.e. power sharing, at various levels to share knowledge and practice and as a mechanism for university teachers to have ownership in visions of change (Knight and Trowler, 2001; Lefoe, 2010)

- to conduct observational studies as a form of assessment; surveys, focus groups and statistics are not sufficient to assess learning and teaching effectiveness in new spaces (Powell, 2008).

Academic development model

Steel and Andrews (2011) designed a model of academic development for technology-enriched spaces whereby teacher challenges are mapped to stages of the model to help teachers move forward. The model is designed to be flexible in terms of activities, accommodation of different academic facilitation styles and preferences, different teacher cohorts and different contexts. The 3 stages of the model cover:

1. opportunities for teachers to explicitly define their pedagogical beliefs;

2. a comprehensive integration of elements designed for teachers to re-imagine their own pedagogical models by identifying affordances and constraints, student profiles and needs, engaging in technological hands-on training and practice in roles of both teacher and learner, reimagining teaching practices for technology-enriched learning spaces, engaging in peer review, and sharing toward safe non-competitive discussion;

3. teachers' application of their designs to their individual pedagogical context with leadership and community support.

Steel and Andrews' model was applied to two case studies:

- An MA Educational Studies course: The program comprised online modules plus three campus workshops aimed at helping participants re-imagine their teaching. Each of the program's two iterations culminated in a portfolio of learning designs for technology-enriched learning places for their individual contexts, and created peer review networks.

- A professional development program for teachers in an urban private school: Buildings consisted of collaborative learning spaces. "Advanced concept" teaching was aimed at supporting transition to university learning. Whole day face to face workshops were supported by online modules over 4 months. Teachers were encouraged to develop their own pedagogical vision for use of the space and had opportunities for reflection and hands-on technology training. The final workshop was a testing arena of mini-teaching sessions with peer reviews. Participants preferred face to face workshops to online modules. The study presents an example of a proactive approach to teacher development in keeping with Long's (2009) view that "teacher development for new technology-enriched spaces should occur prior to the building completion".

Evolving needs

Regardless of the different approaches used to investigate the connections between learning spaces and behaviour, many writers concur that there is a "need to focus on the relationships between contextual, organizational, pedagogical, and social practices of different learning spaces" (Blackmore et al, 2011 p.37).

Due to the lack of empirical research of how individual aspects of the physical environment impact teaching practice, Blackmore et al. (2011) propose new conceptual research frameworks to address ongoing needs and inform school design and future research on learning spaces and student outcomes.

» **Ongoing change and spatial pedagogy**
Higgins et al. (2005) report that in order to support ongoing change, user involvement needs to be supported, continually refreshed and reinforced. Feedback from users can help create possibilities for reconsidering the aspects of school design by focusing on and exploring the complexities of spatial pedagogies.

» **Sustainability**
In order to achieve sustainable impact within changing environments the involvement of teachers and students must be accommodated through all phases from design to evaluation. Sustaining innovation necessarily requires the interconnectedness of whole school organisations, teachers, communities and student voices.

» **Teacher roles**
Blackmore et al. (2011) emphasize the critical role of the teacher. "Unless teachers are prepared for and provided with the necessary professional skills, tools and resources to change their practices, then new built spaces will not move them from default to innovative pedagogies" (p.38). First generation teachers who were part of the design process feel ownership. Second generation, those entering schools, are required to sustain and improve new initiatives in place. Third generation, who expect redesigned teaching practices to be the usual, may be met with differing realities. "Teacher educators therefore have to be prepared to teach how new pedagogies can be mobilised across a range of classroom and school design patterns" (Blackmore et al., 2011, p.23).

» **Intangibles**
There is a need to get beyond the tangibles and consider the intangibles (e.g. classroom cultures, affective, cognitive and social issues). According to Heppell cited in Blackmore et al., 2011, "no one knows how to prevent 'learning-loss' when you design a room 'pedagogically', whereas we know lots about designing for minimum 'heat loss' " (p.38).

In many institutions, academic development in connection with new spaces appears to be somewhat infrequent and often optional as many staff are not trained in teaching practice. Jamieson, Miglis, Holm and Peacock, (2011) claim that "Few academics have given serious thought to how the physical environment of the classroom setting influences their approach to teaching or how it impacts on the quality of the student learning experience. There is a strong need for the development of general guiding principles for teaching staff that help propel change. There is an ongoing need "...to support those innovators who seek to invigorate their teaching through new modes of delivery and ensure that teaching

staff are aware of innovation in delivery models" (Jamieson et al., 2009, p. 2).

Recommendations

Blackmore et al. (2011) recognize a need for multiple approaches to new research studies. Suggestions include longitudinal studies that focus on different teacher and student practices in different spaces; teacher action research exploring use of space and time; case studies of pedagogical practices in use of space and ways of professional development and supports most likely to lead to productive use of new learning spaces.

To address the impact of new learning spaces Jamieson (2003) recommends the use of multi-factor, multi-method analysis to identify learning space characteristics that enhance student learning and support teachers' pedagogical approaches. Guidelines to inform learning space use and teaching and learning effectiveness can be drawn from data and would reflect changes over time.

Conclusion

A de-territorialisation of education is occurring (Thomson and Blackmore, 2006) where control and order may be taken away from a place that is already established. "We now understand that learning spaces are not just classrooms: any space where a student can access a computer; talk with another student; read a book or join peers around a table at a café, is a potential learning space … the whole university is a potential learning space" (Jamieson et al., (2009, p.1). Academic learning spaces are no longer solely static, but nestle in a wide network of relationships of virtual and real environments (McGregor, 2003).

The experiences of teachers and learners affect both their responses to new spaces and their ability to work effectively within them (Lee and Tan, 2011). While the literature fails to provide evidence that new and improved spaces lead to improved student learning outcomes or that student learning experiences were affected positively or negatively by new space facilities, there remains little long-term evidence of changes in teacher practice. Future work is needed to assess whether potential teacher practices, their viewpoints and methodologies change over time. Lee and Tan (2011) ask, "…long term, after the training has finished, do staff continue to work in ways that are intended by the design to particular spaces, or do they adapt the spaces to their practice?" (p.12).

What does this mean for the future of the SAB in terms of sustainability of practice and re-evaluation? Do stakeholders agree, as Winston Churchill remarked, that "We shape our buildings; thereafter they shape us" (Churchill, 1944). Just how changes in technology-enriched new learning spaces influence teacher practice remains under-explored; as do the complexities of constraints and challenges impeding change.

The ideas and challenges discovered in the literature discussed above will inform the multimedia developers, learning and teaching advisors and project officers of the Academic Development Group, who continue to build the capacity of academic and teaching staff in the College of Business to design and facilitate engaging learning experiences in the SAB.

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APPENDIX

Case studies

Many tertiary institutions have similar goals in that new learning spaces will provide settings for innovative teaching practices that offer opportunities for collaborative and student-centred learning. Examining how other colleges and universities implement and use new learning spaces can provide helpful models and lessons for teachers seeking to shift change in practice. A project focusing on learning spaces in higher education conducted by the University of Queensland (Radcliffe et al., 2011) presents a wide range of case studies from *The Next Generation Learning Spaces 2008 Colloquium*. The following case studies from the project describe different kinds of innovative learning spaces and offer examples of how different educational institutions have used their various new spaces, identification of creative pedagogies and descriptions of evaluation methods.

» **Site: University of Queensland** has three innovative Collaborative Teaching and Learning Centres (CTLC) on different campuses, built in 2005, 2007, and 2008 aimed at understanding the relationship between pedagogy, space and technology as well fostering collaborative teaching and learning and supporting changing teaching and learning practice. Post completion, the CTLC provided specialised training to academics. Six of these academics consented to case studies of their teaching methodologies to be shared with peers. Lecturers found that being able to move effortlessly between different teaching modes was advantageous and both teachers and students rated presentation options and the flexibility of a range of teaching activities as very effective design features (Andrews & Powell, 2008). The most common reasons for not using the space were alternative spaces worked better, their class wouldn't fit in the spaces and re-scheduling issues. A crucial lesson for the CTLC is that without continued feedback and collaboration from all users, "...the chances of creating an expensive white elephant increase exponentially" (p.52).

Key lessons
- post-completion, specialised training for academics
- support for changed pedagogy
- on-site case studies shared with peers
- continued feedback from all users

» **Site: Victoria University, Melbourne,** designed a Problem-Based Learning (PBL) space aimed at supporting a transition from traditional lecture-based teaching to PBL. The new design influenced both staff and student behaviour. Students worked collaboratively within the common studio spaces. Teaching staff used the spaces with less authority than in lecture theatres or labs, thus shifting their role "from instructor (i.e. 'sage on the stage') to facilitator (i.e. 'guide on the side')" (Stojcevski et al., 2008, p.59).

Key lessons
- openness to shift of teacher role
- from sage to facilitator

» **Site: The new workshop and seminar space at the Centre for Teaching and Learning at the University of Newcastle** was designed in 2006 to promote student-centred active learning and incorporates flexible seating and cutting edge e-technology. The university held workshops that integrated educational technologies aimed at aligning pedagogy and workshop outcomes, and to ensure facilitators recognise that "Teaching is a scholarly activity and a life-long learning process with no single method or pedagogy that is most effective" (Ali, 2005, p.243, qtd in Huon and Sharp, 2008, p.74). To assist academic staff with teaching roles, academic development sessions were provided to include a focus on modelling teaching and learning approaches for participants to use or to examine their own teaching practice and methods. The university also plans to use interactive video conferencing with satellite campuses to help implement successful and innovative use of teaching space; for example, the use of GenesisTM, an interactive e-technological tool (Huon and Sharp, 2008).

Key lessons
- integrated university IT workshops
- academic development sessions
- modelling teaching approaches
- interactive video conferencing to satellite campuses

» **Site: Melbourne University's new 5-zone Learning Lab,** used by around 1200 1styear chemistry students, was designed to promote collaborative, group approaches to teaching and learning along with seamless access to e-technologies (Tregloan, 2008). The evaluation process to date, has involved focus group discussions spread over various teaching staff teams; tutorial staff, lecturers in different disciplines and Learning Lab tutorials, post-graduate 'class tutors' and program coordinators. The Learning Lab pooled resources resulting in official support and academic expertise from those with a commitment to incremental curriculum change. Pilot programs offered by staff willing to share their practices with colleagues may result in increased confidence in others to adapt and creatively use innovative spaces (Tregloan, 2008).

Key lessons
- focus group discussions for all staff and teachers
- use of pooled resources
- shared practices between colleagues

» **Site: University of Strathclyde,** UK, where learning sessions at the have replaced traditional styles of teaching with methodology embedded in the structure of the lecture theatre using an innovative pedagogic mode of question and answer to engage learners (Jamieson et al., 2009).

Key lessons
- student engagement

» **Site: Bond University** has constructed a kidney-shaped Pod Room, an innovative design to foster interactive group work and sociability that both the University of Melbourne and University of Queensland have effectively trialled. The space accommodates blended learning activities and combines face-to-face teaching and communications technology (Wilson and Randall 2008) and is similar to the SAB Project-Based Rooms. Assessment was conducted by direct observation of 4 teachers as well as a pilot group of 6 teachers from different disciplines who used a Blackboard Learning Community space via blogs, to record their thoughts, ideas and issues regarding their use and student reaction to the Pod Room. Results using data from surveys and interviews showed clearly that while teachers have proven to be quite resilient in coping with any technical problems, the use of this kind of space requires substantial teacher planning (Wilson and Randall, 2008).

Key lessons
- teacher observations
- pilot teaching shared ideas via blogs

» **Site: Stanford University's** Wallenberg Hall in USA, incorporates five high-performance classrooms designed for a user-centred approach. Faculty use the learning spaces to experiment with new ways of teaching and learning to better inform choices made regarding curriculum content and instructional practices. Evaluation efforts, primarily in the occupy phase, are guided by a principle of student and faculty engagement. Continual assessment was conducted over four temporal phases and included classroom observations, surveys, interviews and focus groups (Chen, 2010).

Key lessons
- teacher-student engagement
- use of continual, multiple assessment methods over all phases

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