What are sustainable or generative teacher skill sets in teaching and learning within open plan learning environments?

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List of Acronyms

ACARA	Australian Curriculum Assessment and Reporting Authority
AusVELS	Australian Victorian Essential Learning Standards
BEP	Bendigo Education Plan
BER	Building the Education Revolution
BSF	Building Schools of the Future
CELE	Centre for Excellent Learning Environments
COAG	Council of Australian Governments
DEEWR	Department of Education, Employment and Workplace Relations
DET	Department of Education (formally DEECD Department of Education and Early Childhood Development) (Victoria, Australia)
DETS	Digital Education and Technology in Schools
DfES	Department for Education Skills (UK)
EFEI	Educational Facilities Effectiveness Instrument
ICT	Information Communication Technology
NAPLAN	National Assessment Program – Literacy and Numeracy
OECD	Organisation for Economic Cooperation and Development
PEB	Programme on Educational Building
PISA	Programme for International Student Assessment
SC	Secondary College
SFO	Student Family Occupation
TALIS	Teaching and Learning International Survey
VCAA	Victorian Curriculum Assessment Authority
VCAL	Victorian Certificate of Applied Learning
VCE	Victorian Certificate of Education
VELS	Victorian Essential Learning Standards

Abstract

This study investigated teachers' emergent practices as they attempt to provide twenty-first century learning experiences in open-plan learning environments. The broad challenges to the industrial era model of education are coupled with the compelling need to provide contemporary learning processes. The focus on constructivist, student-oriented, collaborative, and personalised learning that is ICT-rich further establishes altered conditions requiring a new set of skills for teachers. This study examines the question, "What are the sustainable or generative skill sets in teaching and learning within open plan learning environments?"

Drawing on a multi-theoretical framework, including structuration theory (Giddens, 1984), relational agency (A. Edwards, 2005, 2009) and affordance theory (Gibson, 1977), this study focused on the heightened agency of teachers and students as expressed through both educational developments in constructivist pedagogies and architectural principles of openness, flexibility, humanism and democracy (Boddington & Boys, 2011; McGregor, 2004c; Melhuish, 2011; Upitis, 2004).

In a multiple case study approach over two years I examined three school sites with open-plan design in regional Victoria. Field data included interviews with teachers and principals as well as a group interview with students. Observations of teaching were also conducted across the sites. The fine grain examination of teacher practice provides an opportunity to establish emergent patterns ground in lived experiences of altered school settings.

The study found that open plan settings functioned as complex and intensified environments affording a range of practices and system responses. School level responses to the affordances of the space have made collaboration, adaptability and team orientation necessary features of the ongoing practice. The study explores the enablers and constraints in these settings on existing and desirable teacher skills. Metaphors and language to describe teaching practice are also considered in light of the altered conditions. The sustainable or generative skills require an ongoing and reflexive

relationship with the brute physical space and the curriculum overlays established at school level.

Statement of Authorship

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma. No other person's work has been used without due acknowledgment in the main text of the thesis. This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

Signed:

13 November, 2015

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I dedicate this study to my wife Alison and my children Sabine, Soledad, Raphaella and Valentino.

In loving memory of Sabine Alterator Musk (2000-2014)

Chapter 1 Introduction

The focus of this study is the emergent skill set of teachers engaged in attempts to provide twenty-first century learning within open plan learning environments. The schools examined in the study cover the full range of secondary school year levels.

Background to the study

Challenges

Education systems across the world face major challenges in the early part of the twenty-first century. Broadly conceived as the knowledge society or economy, the central role of education in national development is reaffirmed (OECD, 2006a). The development of the information-age and the increasing focus on personalisation of learning has led education systems to attempt a range of measures to improve the richness and quality of learning. Designing curriculum capable of responding to a contemporary setting and developing relevant skills and knowledge remains a concern for systems generally (Council of Australian Governments, 2008; Darling-Hammond & Bransford, 2005; OECD, 2012; Prain et al., 2014c). School systems have turned to redesigning learning spaces to affect change in pedagogical practice, teacher development and learner behaviours (Kuuskorpi & Gonzalez, 2011; Lippman, 2010; Oblinger, 2006; Prain et al., 2013). The resulting changes to teaching and learning experiences present a critical juncture for understanding teacher expertise.

Contemporary society offers access to immense volumes of data through a variety of information streams. The continuing pace and accessibility of information technology affect all facets of modern life: social and school/work life behaviours are increasingly interdependent (Gardner & Davis, 2013). Graduates are expected to be competent managers of this vast, interconnected technosphere: in short, they must be active participants in the globalised knowledge economy.

The impact of information and communication technologies (ICT) is acknowledged as significant (D. Edwards, Deed, & Edwards, 2014; Hershkowitz &

Schwarz, 1999; Hirumi, 2002; Oblinger, 2004). The exploration of technology is represented in an ever-growing body of education literature: virtual learning spaces, games-based learning, blended learning, and social/online knowledge construction.

While the impact of ICT on students and how they learn has consequences for understandings of quality learning and pedagogy, this study is focused on physical spaces. The interplay between ICT and physical space and its capacity to establish personalised learning spaces is acknowledged and referenced as part of the general argument for a quality curriculum (Deed, Lesko, & Lovejoy, 2014).

A further challenge is presented in the shift toward personalised learning. This strategy sees the centre of gravity shift toward the students and away from the teachers (Mahony & Hextall, 2009; Prain et al., 2013). Such a strategy is recognised as requiring significant change from teacher-oriented instruction toward students and teachers working in teams with peers and together in order to enhance learning (R. J. Campbell, Robinson, Neelands, Hewston, & Mazzoli, 2007; M. Fielding, 2004a; Kuhn, 2011).

The complexity of enacting such a learning experience is evident in the factors identified by Prain et al. (2013) as impacting a school's capacity to implement it: "school leadership, teacher skill sets and practices, and learner capacities and goals" (p. 7). Educators are under pressure to adapt schooling practices in response to these developments. Schools designed on nineteenth century, industrial principles are necessarily limited in the modern context (McGregor, 2004b).

Quality teaching and learning is understood to be composed of student-oriented strategies taking in authentic tasks focused on student participation and creation, is ICT rich and personalised. In this way it is referred to in this study as a process as distinct from carrying any particular preferred content.

There has been a range of responses to the challenges facing education. Pedagogical developments and curriculum structures have generally moved hand-in-

hand to settle on a constructivist paradigm. Since the mid 1990s school systems across the world have used building design as a strategy to achieve change. This research focuses on the emergent teacher skill sets and expertise within open plan learning environments attempting to implement customised, technologically rich curriculum programs.

Responding to the challenges through physical environments

Physical environments have featured in school reform for several decades. An initial response in the 1970s and 80s occurred largely as a reaction and can be characterised as revolutionary (Deed & Lesko, 2015). Recent understandings of learning spaces have developed in line with understandings of students as agents (Sagan, 2011), learning as dynamic, student-oriented and personalised (McGregor, 2004b; Prain et al., 2013; Upitis, 2004), with a high degree of pedagogical flexibility required to achieve success (Boddington & Boys, 2011).

System wide responses have occurred at national and international level. The United Kingdom and Australia have invested significantly in system reform centred on physical spaces since the early 2000s. The Organisation for Economic Cooperation and Development (OECD) first established a mandate for the Programme on Educational Building (PEB) in 1972 (OECD, 2011). Today, the OECD tracks numerous member countries engaged in innovative education and provides broad impetus for policy developments sensitive to the changing needs of students in the twenty-first century (Kuhn, 2011, p. 19).

The response of the British Government to the challenges of providing a twenty-first century education is seen in the Building Schools for the Future (BSF) program. Launched in 2003, the BSF outlined an ambitious program of building renewal with the aim of addressing degenerating facilities and decreasing engagement and performance. This would be achieved through the employment of principles of transformation, redistribution, regeneration, and participation (Mahony & Hextall, 2012).

> Thus BSF combined a formidable expansion in the infrastructure of social and educational provision with explicit themes of economic, social, educational and community transformation. (Mahony & Hextall, 2012, p. 2)

The abovementioned challenges inspired a similar system-wide response by the Australian Government. The Building Education Revolution (BER) was launched in 2009 and identified two key objectives:

> 1. Provide economic stimulus through the rapid construction and refurbishment of school infrastructure.
> 2. Build learning environments to help children, families and communities participate in activities that will support achievement, develop learning potential and bring communities together. (Australian Government, 2011, p. 2)

The first goal is clearly part of a broader political and economic agenda but requires including because it stands as a key part of the government's strategy. Nevertheless, the agenda remains pertinent because it identifies a clear attempt by the government to respond to the changing demands of education provision. According to the Department of Education, Employment and Workplace Relations website, up to November 2012 the BER has provided funding to 24,000 infrastructure projects for 9,500 schools across Australia (2012). Many of the projects resulted in schools adding a substantial percentage of teaching space (in some cases entire schools) as open-plan style facilities.

Bendigo Education Plan: A local response

This study focuses on the implementation of the Bendigo Education Plan (BEP) (Department of Education and Training, 2005). The BEP is a local response to the same set of challenges facing education across the globe. The scale of the project ought not be underestimated. It involved the complete rebuilding of five secondary schools into four, providing education to more than 3,300 Years 7-10 students. It is worth noting

that the program included all public secondary schools servicing the provincial city of Bendigo.

The BEP can be characterised as sharing a similar broad objective to that of the BER. The BEP identified three critical pillars:

- The needs of Bendigo youth are central to our core enterprise;
- Schooling in the future will be part of dynamic learning networks;
- Learning itself will be revolutionised by depth, authenticity, learning choice, challenge and technological connectivity. (Department of Education and Training, 2005, p. 3)

The three critical pillars align with the broader educational challenges of meeting individual student needs in a dynamic and inconstant society (Hattie, 2009; Mahony & Hextall, 2009), and meeting the needs of the twenty-first century learner (Ledward & Hirata, 2011; Rychen, 2003). The need for institutional change – from traditional to flexible (Kuhn, 2011; McGregor, 2004b; OECD, 2006a) – can be seen by examining areas the BEP identified as warranting particular consideration: curriculum; teachers; community engagement and sound governance; and school design.

This study recognises the interrelatedness of all five areas and acknowledges the difficulty in separating individual components. Nevertheless, careful consideration of particular components can assist in deciphering the new contexts and can inform the work of teachers and leaders.

The building of open plan learning spaces and the adoption of a learning community model has profoundly impacted curriculum design and enactment. The BEP identified the following guiding principle in the design of the new schools: “designs should provide large, flexible spaces to allow teams of teachers to work with up to 125 students in learning neighbourhoods using a range of approaches and activities” (p. 35).

Study Focus: Teacher practice in open plan settings

The emergent practices of teachers working in open plan learning spaces are the focus of this study. The transformative initiatives of the BEP have necessarily impacted the work of teachers as they engage in a workplace considerably different to that which preceded it. An understanding of the open plan spaces and how they are developing under the BEP model is a central factor. The open plan designs reveal a complex situation where teachers and students are interconnected through teaching and learning in the physical co-location of learning spaces, breakout zones, staffrooms, and facilities. Further, the nature of the spaces demand that teachers work collaboratively, often planning and co-teaching in spaces with a high degree of visibility. Moreover, concepts of authority and autonomy are being re-shaped as students engage as active participants in the open plan settings.

Significance of the research

This research has potential significance in addressing the need for knowledge of practice occurring in up-scaled open plan learning environments. As teachers, students, parents and education systems engage with the new school settings, knowledge of their operation, impact and potential is required. The detailed account of the lived experience across two years offers a fine grain account of occupying the school sites.

The degree to which the spaces impact the regular daily work in schools is of considerable interest to individuals and systems. Further, the scope of the school leaders and teachers to harness the potential of the space to generate dynamic, personalised learning experiences remains unmapped.

As the open spaces are normalised into practice, the emergence of ideas of expertise can be considered. The interplay between existing and emerging ideas of teacher expertise present a unique and fertile juncture for this research. It is hoped the findings of this study will contribute to the conception of expertise as well as the programs preparing students for the work of teaching in the open plan settings.

Further, the need for a reliable conceptual model capable of assessing the open spaces beyond architectural intent is required in determining the capacity of the settings to contribute to a twenty-first century education.

The extensive presence of the BER establishes the potential reach of this study. In Bendigo, in particular, the explicit goals of the BEP may be considered in light of the findings of this study. The significance of the study has local and system-wide relevance.

Aims of this study

Key questions of the study

Accepting the central role of teachers in creating and sustaining the learning environment and in shaping and enacting curriculum, this study identifies the following key question:

- What are the sustainable or generative teacher skill sets in teaching and learning within open plan learning environments?

The following questions will inform the central question:

- What are enablers and constraints contributing to teaching and learning in open plan settings?
- What conceptions of collaboration in traditional settings contribute to our understanding of collaboration in open plan settings?
- What constitutes expertise for teachers in the open plan settings?
- What are the theoretical and practical implications of these findings?

Background to the Bendigo Education Plan

The BEP (Department of Education and Training, 2005) involved the reconfiguring of six local high schools; four Years 7-10 schools, a P-10 school and one VCE campus (Years 11 & 12). The six schools were merged into four Years 7-10 campuses and the one VCE campus remained as part of the new structure. A steering committee and an executive committee authored the plan.

The five areas for consideration (above) are a response to data from a range of sources. Taken together, they establish a clear impetus for change: socio-economic profiles; Centrelink (government social service provider) statistics; school level report data; the Bendigo Education Outcomes and Opportunities Project (Teese, 2005, unpublished); and student attitudes to school data.

Socio-economic profiles of the Bendigo schools revealed that all secondary schools have a "significant group of students in the lowest socio-economic group" (Department of Education and Training, 2005, p. 9) with "two schools having more than 40 per cent of their enrolment from families in the two lowest family occupation groups" (Department of Education and Training, 2005, p. 9). In 2005 one school had 58 per cent of parents in those two categories.

The BEP also reported that a large number of school-aged people in the City of Greater Bendigo area were engaged with government unemployment services through Centrelink. The plan acknowledged a need to develop strategies that reengaged these young people with education (Department of Education and Training, 2005). State government goals for retention in government schools also contributed to the compulsion to address this concern.

Further impetus for change was taken from the school level report data for each school. The plan examined a range of factors including attendance, retention and parent and staff opinion. While the plan acknowledged that a sound educational experience is provided, there are significant variations in individual school and teacher performance. The plan conceded that there were "significant opportunities for improvement, especially in the engagement and academic achievement of students across the 7-12 spectrum" (Department of Education and Training, 2005, p. 11).

The BEP provided a summary of the particular strengths and weaknesses of the Bendigo government secondary schools across year levels 10, 11 and 12. The summary acknowledged the positive learning experience of students in the senior years but

identified issues for students who seek work and those who wish to be challenged. Specific observations of teaching were also made: “as regards teaching, the concerns of both higher and lower achieving students are over pedagogical emphasis rather than subject expertise or commitment to individual needs. i.e., greater interaction and more stress on interests are expected” (Department of Education and Training, 2005, p. 13).

The plan identified a set of outcomes to be improved. These work as goals that, in turn, shape the areas for consideration. (The areas for consideration contain the details equating to strategies.) These outcomes are:

- That there is substantial improvement in student retention from years 7 to 12 to meet Government targets;
- That a significantly increased range of subjects and courses is available to Year 9 and 10 students;
- That strategies are developed and implemented to significantly improve attendance, particularly for students in Years 7-10;
- That all students, particularly high achieving students, are challenged further in their studies and strategies are developed to address this;
- That strategies are developed to improve the engagement of students and their interest in subjects, particularly for average and low achieving students and those from lower socio-economic backgrounds.
- That strategies are developed to improve the knowledge and practice of highly effective teaching to improve academic outcomes, classroom management, discipline and wellbeing of students.

  (Department of Education and Training, 2005, p. 15)

Reporting on the full range of goals and strategies is beyond the scope of this study. The focus of this study is the work of teachers as they shift toward strategies designed to address the outcomes identified as part of the plan. The move toward personalised, collaborative learning through innovative curriculum programs is recognised as a response to the intended outcomes of the BEP. The strategies are

aligned with the broad currents of twenty-first century education (Darling-Hammond & Bransford, 2005; DfES, 2004; Fullan & Langworthy, 2014; Hirumi, 2002; Ledward & Hirata, 2011). The open plan learning spaces further demands teachers adapt their practice and establish relevant skills and expertise.

Research approach

The existing body of research specific to open plan schools is characterised as limited by scope and detail. The educational research is usually limited to quantitative scrutiny of the impact of physical space on learning outcomes and behaviour (Blackmore, Bateman, O'Mara, & Loughlin, 2011; Woolner, Hall, Higgins, McCaughey, & Wall, 2007). Architectural literature indicates an interest in occupation but the research seldom moves beyond theorising on broad principial links between design and education (Higgins, Hall, Wall, Woolner, & McCaughey, 2005). The research gap is recognised as appearing in the examination of practice occurring in the open plan spaces (Cleveland & Fisher, 2013; Gislason, 2010).

This study identifies the practices occurring in the open spaces through a fine grain examination of the lived experience. The school level response to the open space is identified as impacting the work of teachers. These practices occur within the open plan and in relationship with the curriculum context. The focus on developing teacher practices in the novel settings allows for the identification of emergent skill sets and expertise.

Teacher knowledge is understood as occurring as part of a phenomenological and pragmatic epistemology. Knowledge is constructed through the relationship between practice and consequence (Bacon, 2012) as part of an active, exploratory process (Dewey, 1963). As teacher knowledge has developed to be understood as a mixture of theoretical and practical knowledge (D. Hargreaves, 1997; Verloop, Van Driel, & Meijer, 2001), a focus on the practice of teachers to identify skills and expertise is justified.

This study employs a multiple-case study approach drawing on a range of qualitative research methods. Interviews with teachers and school leaders are combined with close observations of practice in establishing data. Interviews with students were used as corroborative indicators against teacher interviews. Further, school level structures are examined to determine a detailed site-specific context within which to read the emergent practice.

Conclusions are developed using a two-phase analysis (Yin, 2006) informed by two theoretical constructs: structuration theory (Giddens, 1984) and affordance theory (Gibson, 1977). Structuration reads social structures as contingent on agent participation and ongoing engagement. This lens is particularly relevant in reading the intersection between existing traditions of practice and the invitation to new practices through the possibilities of the open plan spaces. Affordance theory plays a similar role in enabling the research to identify those factors impacting the practice of teachers and offers orientation for understanding the phenomena taking place.

Researcher background

My professional experiences led me to an interest in open plan learning environments. Prior to commencing the research I was teaching at one of the case study school sites. My leadership positions allowed me to be involved in cross-school committees as part of the BEP. As head of a curriculum area I also undertook to develop practice in an open plan learning space. The impact of physical space on the teachers and students was part of my day-to-day responsibility as well as broader administrative considerations.

My role as School Centres for Teaching Excellence liaison between La Trobe University and BEP schools focused on positioning and mentoring of student teachers in open plan settings. This allowed me to spend extended periods of time immersed in the open plan settings of the case study schools. Further, I ran professional development for BEP teachers specific to mentoring student teachers in the open plan learning spaces.

These experiences aided in developing my early ideas for research through contact with teachers, school administrators, and in observing practices of teams. This allowed me to pinpoint particular phenomenon relevant to the theoretical orientation and in answering the research question.

Chapter 2 Literature review

Introduction

This chapter presents a review of the relevant literature informing the research. The unique setting of open plan learning environments presents a challenge for researchers as knowledge and theories embedded in traditional settings struggle to account for the new experience. The literature review provides the grounding to identify opportunities for generative insights in answering the central research question.

The challenge of establishing the sustainable or generative teacher skill sets in teaching and learning within open plan learning environments requires an examination of a range of elements.

These elements are understood as constituting a complex system of interrelated factors converging upon quality teaching and learning experiences. This quality will be established to relate directly to the inheritance of educational trends such as student-oriented pedagogical developments within a constructivist frame, personalisation of learning, and increased autonomy for students and teachers (agents). It will also consider dynamic curriculum developments that are still in the process of adjusting to the demands and needs of a technologically rich society.

The impact on teacher knowledge and models of expertise will be considered. Taken together, these elements combine to present a significant challenge to industrial-age thinking. The study will also consider the impact of the discipline of architecture inasmuch as it is considered a stakeholder with relevant expertise. Theoretical developments around agency, affordances, and space have influenced educational and architectural understandings. The intersection of the two disciplines presents a fertile common ground assisting to position the study within the literature. This theoretical orientation is considered in a separate theory chapter immediately following the review of the literature.

Critiques of open plan spaces will be addressed at opportune junctures. The breakdown of critiques in this way allows for the treatment within the context of the literature being examined. Practical and theoretical concerns are offered as part of the discussion of the relevant literatures. A summary of major critiques is provided as part of the summary of this chapter.

Twenty-first century education

The twenty-first century context places demands on students to consider themselves global citizens, be creative thinkers with adaptive skills, navigate great swathes of information and construct their identity in a physical and increasingly digitised mode. Further, Web 2.0 technologies have increased the scope and realisation of interconnectivity and virtual communities (D. Edwards et al., 2014; Gardner & Davis, 2013; Hirumi, 2002). Moreover, education has come to recognise the diversity within schools and classrooms with customisation of learning a focus of research and system reform in recent decades (ACARA (Australian Curriculum Assessment Reporting Authority), 2013a; Council of Australian Governments, 2008; M. Fielding, 2004b; Prain et al., 2013).

The Teaching and Learning International Survey (TALIS) report conducted by the OECD outlined the challenge and the response:

> In modern knowledge-based economies, where the demand for high-level skills will continue to grow substantially, the task in many countries is to transform traditional models of schooling, which have been effective at distinguishing those who are more academically talented from those who are less so, into customised learning systems that identify and develop the talents of all students. (OECD, 2009, p. 3)

The literature generally represents quality teaching and learning experiences to encompass a response to the demands of the twenty-first century knowledge society (Fullan & Langworthy, 2014; OECD, 2006a). Education, through learning theory,

curriculum reform and teaching and learning is recognised as still in the process of responding to these demands (Hattie, 2009; Leiringer & Cardellino, 2011; McGregor, 2004a; OECD, 2006a).

As education systems adjust traditional models there is a clear revelation of gaps in knowledge and research. This study has selected salient areas of focus and highlighted the relevant gaps or disparity between research and open plan practice.

Context of Development

Learning theory in the twenty-first century: A student-oriented approach

Education theory across the twentieth century has seen considerable change. Theories drawing on behavioural psychology (Pavlov, Skinner) have largely given way to cognitive and socio-cultural traditions (Killen, 2009; Krause, Bochner, Duchesne, & McMaugh, 2010). Traditional models of education have been challenged by the work of Dewey, Freinet, Montessori, and others for more than a century. Subsequently, these insights have seen the development of student-oriented pedagogies with a focus on authentic participation and understanding. Technology in its various forms, the Web and personal devices in particular, have further eroded traditional models and work to demand a reconsideration of constructivist ideas.

Much of the pedagogical and educational psychology textbook literature present a range of theory (cognitive, behavioural, humanist) and recommend a balanced approach to implementation (Killen, 2009; Krause et al., 2010; McInerney & McInerney, 1994; O'Donnell, 2012). Nevertheless, a constructivist/humanist paradigm has come to dominate pedagogy and curriculum (ACARA (Australian Curriculum Assessment Reporting Authority), 2013a; Council of Australian Governments, 2008; OECD, 2006a).

The first constructivists include Piaget and Vygotsky with Piaget attributed as coining the term ‘constructivism’ (Glasersfeld, 2005). The field has diversified to include a number of interpretations (social and radical constructivism, progressivist and reactionary constructivism) (Phillips, 1995); nevertheless, there are discernable central tenets.

Constructivism generally holds that the individual constructs knowledge. The process is understood as internal and particular to the individual acting as an active organism (John-Steiner & Souberman, 1978). Constructivism sees students as active, social, and creative participants (Perkins, 1999; Phillips, 1995). Vygotsky (1978) held that education is erroneous in determining developmental levels through testing; such an approach orients the learning toward previous achievements or existing knowledge and wrongly limits strategies for learning. Instead, learning ought to be understood as establishing conditions for development and as occurring as a necessarily individualised process through internalisation and subsequently socially mediated confirmations (1978, 1998).

The broad shift away from transmissive teaching modes toward socially constructed knowledge dominates the key curriculum constructs in establishing a picture of the twenty-first century context. For instance, the national curriculum (ACARA (Australian Curriculum Assessment Reporting Authority), 2013a), and the Melbourne Declaration on Education (Council of Australian Governments, 2008).

Bruner (1990) suggests that the theory centres on making meaning out of information and experience. It is also informed by Piaget's cognitive model of development but the particular psychological manoeuvres are beyond the focus of this study. Theoretical concerns of constructivism centre on the epistemology of the construct but have considerable ramifications for the socio-political and educational domains (Dewey, 1916; Glasersfeld, 1991; Phillips, 1995).

The acceptance of the limits of subjective experience means that we are obliged to formulate an understanding that posits knowledge as stemming from within these limits (Glasersfeld, 2002). Knowledge is constructed "without reference to anything outside the experiential confines" (Glasersfeld, 2005, p. 11). Indeed, Glasersfeld prefers a post-epistemological tag for constructivism and posits it as a theory of knowing as distinct from a theory of knowledge (Glasersfeld, 1991).

The impact of constructivist framing of learning is seen in the expanded pedagogical repertoire. A progression from group work through student-oriented project-based work toward authentic engagement within an extended learning community places an expectation on the type of physical space available. Open plan learning spaces are seen as offering the requisite freedom to service and expand this repertoire.

The popularity of constructivism within education is supported by the parallel rise of the thinking of John Dewey (Dewey, 1938, 1997/1938). Dewey's foundation in philosophical pragmatism saw knowledge accepted as embedded, subjective and contingent. His focus on experience saw a radical shift in education. "We have the problem of ascertaining how acquaintance with the past may be translated into a potent instrumentality for dealing with the future. We may reject knowledge of the past as an *end* of education and thereby only emphasise its importance as a *means*" (Dewey, 1997/1938, p. 23).

Dewey saw the need to develop a perspective and practical approach that saw experience guide education potentialities (McDermott, 1973). Of equal importance is Dewey's insight that knowledge creation is inherently social (Dewey, 1916; Quinton, 2010).

Dewey's views on education are characterised as progressive and gave rise to a movement that challenged an education that was "predominantly static in subject-matter, authoritarian in methods, and mainly passive and receptive from the side of the young" (Dewey, 2010, p. 244). Further, he saw the realisation of a focus on experience and action in progressive education to mean student participation.

Education in the twenty-first century has inherited a range of constructivist ideas. It is influenced by pragmatist epistemology, Dewey's ideas of active, future-oriented learners, and the move away from transmissive techniques in favour of those asking students to be critical, creative and engaged. Phillips (1995) concedes that, post Locke's *tabula rasa* insight, we are all constructivists.

The implications for this research is to determine instances where the open plan learning settings afford practices consistent with constructivist pedagogy to establish quality teaching and learning. The goals of the BEP are, ostensibly, to shift away from the transmissive stagnancy described by Dewey and others toward creative and critical learners. The selection of sites and particular instances of practice have been made to ensure the data derives from attempts to enact learning experiences consistent with the description of twenty-first century education.

Trend toward ICT use across Westernised education systems

The trend toward ICT use is consistent across westernised education systems. The OECD provides a shorthand notation summarising international trends through various reports. Inasmuch as these are limited as a justification for empirical research, they reveal general trends and indicate fertile ground for exploration. The annual report *Education Today 2013* outlined key findings from 2009 Programme for International Student Assessment (PISA) survey data (OECD, 2012, 2014). The report identified that less than one per cent of students in OECD countries declared that they had never used a computer. This level of saturation is an indication of a range of factors including social and economic, but it is also a result of policy that prioritises ICT in schools.

The PISA data also concluded that the frequency of computer use at home is not matched by levels of use at school. Further, the report found that there was a "stronger correlation between educational performance and computer use at home than with its use in school" (OECD, 2012, p. 36). As well as raising awareness of the consequences of ICT use amongst educators, parents and policy makers, the report makes explicit links between ICT competence and twenty-first century skills.

The broad outline of these findings can be seen in the response of the Australian Government through the implementation of the Digital Education and Technology in Schools (DETS) program. The explicit goal of the program is as follows:

The Australian Government supports the use of new technologies in Australian

schools to prepare students to learn, train and live in a digital world. (Australian Government, 2012)

The DETS initiative includes the Computers in Schools project – one laptop for each student in high school – National Broadband Network Enabled Education, as well as a variety of development opportunities for innovation and collaboration. Perhaps most tellingly, the implementation of the Australian National Curriculum is closely aligned with DETS through the development of online curriculum and assessment tools.

The pressures exerted by the ubiquitous presence of information and communication technologies, along with the influence of constructivist learning theory, have resulted in pedagogical developments.

The realisation of these philosophies can be seen in the highly influential work of Bloom (Bloom, Krathwohl, & Masia, 1956), Gardner (2011) and initiatives such as Project Zero (Harvard University, 2014). Each have an emphasis on extending students beyond lower-level tasks such as recall and reporting, toward a more holistic approach that lead to tasks focused on analysis and evaluation. Each attempts, in a way, to systematise the actions of students (and teachers) in order to encourage and routinise thinking that is largely student-focused, creative, and geared for understanding.

The combined influence of constructivist learning theory, challenges to traditional models, pedagogical insights and the forces of information technologies can be seen in the work of Fullan and Langworthy (2014). The work, *A Rich Seam*, is a Pearson commissioned international project seeking to explore the significant developments in education globally. In Australia the Victorian and Tasmanian Education Departments are project participants. The impact of the international partnership to establish and expand new pedagogies is clear; the potential reach of the findings is immense.

Fullan and Langworthy (2014, p. 2) see the combination of the pedagogic heritage and new technology as establishing new pedagogies. These have “greater

precision, specificity, clarity, and above all greater learning power". A particular synthesis of the relevant currents across the twentieth century is seen in the emergence of pedagogy that involves knowledge creation in real world settings. This is manifest in "new learning partnerships that emerge between and among students and teachers when the learning process becomes the focal point for the mutual discovery, creation and use of knowledge" (2014, p. 3). It is seen as a response to and enabled by access to technology at school and beyond.

The development of a student-oriented approach to learning can be said to be a response to the transformation of traditional models of teaching and learning (McGregor, 2004b; OECD, 2006a), the influence of information and communication technology (Bonk & Cunningham, 1998), and the shift toward a consumer based philosophy in education provision (Mahony & Hextall, 2009).

This study examined practices that were instances of the pedagogy described by Fullan and Langworthy (2014) and consistent with the broad shifts in thinking away from industrial era models toward a student-oriented model. The study provided the lived experience of such pedagogy recognised as not present in the literature.

Twenty-first century curriculum reform in Australia

Curriculum programs have been impacted by the material developments of the twenty-first century as well as the move toward constructivist, student-oriented theory (R. Edwards & Usher, 2000). This has resulted in curriculum reform in Australia that is variously described as anachronistic, overly political and deliberately reformist, as well as containing fragmented interests, oppositional discourses with a tension between theory and practice (Lynch, 2014; McDonald, 2003).

The Australian National Curriculum is testament to the tensions and frictions inherent to such an undertaking. Moreover, recent shifts toward centralised testing and international benchmarking (ACARA (Australian Curriculum Assessment Reporting Authority), 2013b; OECD, 2014) stand as evidence to the variety of tensions felt within

education as systems adjust to a globalised world with increasing economic pressures (M. Fielding, 2004b; OECD, 2014).

A point of focus taken to progress this study is the attempt to establish the Australian Curriculum (ACARA (Australian Curriculum Assessment Reporting Authority), 2013a) as a system catering for individual learner needs based on an understanding that the performance markers are relatively fluid. Likewise, there is recognition that the curriculum is aiming for "deep knowledge, understanding, skills and values that will enable advanced learning and an ability to create new ideas" (2013a, p. 8). Further, that capabilities are developed that "underpin flexible and analytical thinking, a capacity to work with others and an ability to move across subject disciplines to develop new expertise" (2013a, p. 8).

The schools being scrutinised in this study are answerable to the National Curriculum and it offers a starting point for establishing a vision of quality in teaching and learning. The National Curriculum provided further impetus to pursue the type of learning experiences identified as salient to informing this study. Efforts at implementing the curriculum in the BEP open plan settings indicated a range of impacts on teacher practices as they worked to establish quality learning experiences.

A vision of quality teaching and learning

Quality teaching and learning experiences are understood to be a response to the development of the education philosophies, material developments in school spaces and information technology, and resultant pedagogical approach outlined above. A vision of quality is developed here with a focus on the constituent parts of contemporary quality. This is distinct from a focus on content or subject discipline. The vision is a product of the contemporary context taking in learning theory, educational psychology and developments in pedagogy. In remaining focused on process it is also able to develop in line with the potential of the large-scale open plan spaces central to the context of the study.

Quality teaching and learning experiences have a diverse representation in the literature. They usually centre around constructivist concepts, or at the least are student-oriented, and are labelled variously as rich learning, deep learning, life-long learning, personalisation and differentiation, customisation, and ICT-rich (Boddington & Boys, 2011; Department of Education and Training, 2003; Fullan & Langworthy, 2014; Hattie, 2009; Killen, 2009).

The basic tenets of this approach include active learning, open-ended activities, cooperative or collaborative learning, reflective practices, higher-order thinking or deep thinking, multi-phased tasks, and negotiated tasks and assessment with assessments occurring in a variety of modes (Bonk & Cunningham, 1998; Bransford, Franks, Vye, & Sherwood, 1989; Felder & Brent, 1996; Hershkowitz & Schwarz, 1999; Hirumi, 2002).

This is consistent with the recommendations of the BEP that include building breadth and depth in authentic learning experiences. It recommends a personalised approach to learning as the central principle to guide education for students of the twenty-first century. The BEP prioritises the skills of problem solving, synthesising and evaluating (Department of Education and Training, 2005).

Personalised learning is recognised as a means of achieving higher levels of engagement while encouraging independence and responsibility. Despite the definitional vagueness outlined by Prain et al. (2013), a reasonable attempt at a general outline of the principle is achieved by Mahony and Hextall: “an attempt to relocate the centre of gravity… of education, away from the producers/providers of the services towards the users or consumers” (2009, p. 8).

Kuhn (2011) outlined personalised education – the attempt to maximise individual talents through highly individualised learning strategies – as requiring both students and teachers to “interact in a variety of teams, work on different projects and also monitor and discuss each others learning progress” (p. 23).

Similarly, Campbell et al. (2007, p. 138) stress that personalisation is not marketisation; rather it is the "promotion of self-realisation, with children constructed as active and responsible co-authors of their educational script".

Collaboration and autonomy play a role in establishing quality learning. Collaboration has a presence in models of teacher quality with ideas of substantive communication and substantive conversation (Killen, 2009); however, this articulation is limited for expanding on rich learning. Fullan and Langworthy (2014, p. 12) reinforce the need for authentic learning partnerships that are "genuine, (have) reciprocal accountability and mutual benefit".

Autonomy is understood as empowering students to take control of actions and centres on establishing agentic students compelled by increased levels of responsibility to achieve intrinsic motivation (Stefanou, Perencevich, DiCintio, & Turner, 2004). Autonomy as a goal for students is consistent with personalisation outlined above and ensures that the warnings against shallow versions of autonomy are avoided. The impact on teachers striving for autonomous students is similar to that of personalisation with strategies tending toward autonomy support. This involves fostering relevance, providing choice and allowing criticism of the task to encourage independent thinking (Assor, Kaplan, & Roth, 2002). Autonomy support has been determined by others to take in various strategies such as organisational, procedural and cognitive autonomy support (Stefanou et al., 2004). This study acknowledges the need for genuine choice with a level of engagement taking in a degree of critical reflection on self and the program.

Information and communication technology is central to understanding rich learning experiences. Bonk and Cunningham (1998) and others (Bruns, 2007; D. Edwards et al., 2014; Fullan & Langworthy, 2014; Hirumi, 2002) identified the advances in technology as eroding the traditional teacher-centred model. In this way it has played a role in bringing about change. The consequences of this change are understood to be part of the answer to achieving authenticity: "In the process of shifting our ideas to the constructive activity of the learner, we recognise the need to anchor learning in real-

world or authentic contexts that make learning meaningful and purposeful" (Bonk & Cunningham, 1998, p. 27). Technology is assisting and agitating the shift away from traditional models and is an essential element in producing the new, rich experience.

A response to the challenge of creating rich learning experiences in the twenty-first century that are fundamentally personal and authentic permeates the literature. Though the particular forms of operationalising such an approach varies considerably, the broad philosophy is consistent.

It is judicious to consider the attempts to create rich learning by manipulating the physical surrounds of the learning environment. This study recognises that there is an interplay between the theorising of the learning environment and its practical development (Lippman, 2010).

The implication for this study has been to select the spaces and practices within them that indicate gains in teachers' efforts to establish quality learning. The lived experience of teachers and students in these spaces provide the empirical data used to examine the impact on teacher practices.

Quality learning and teaching and physical environments

It is clear that ideas about rich learning experiences have informed and shaped possibilities for learning environments (Kuuskorpi & Gonzalez, 2011). The centre for excellent learning environments (CELE) has outlined the consequence of twenty-first century approaches for school design.

> More interactive models have replaced the traditional teacher-centred model of learning to place students and teachers at the centre of the educational process. School design has an important role to play in facilitating innovative pedagogical methods. (OECD, 2006a, p. 12)

Indeed, the very idea of a learning environment has come to influence considerations of school architecture and its possibilities. Kuuskorpi and Gonzalez

(2011, p. 2) conducted a study across six European countries to determine the composition of a learning environment. They concluded that it consisted of four learning contexts: “social, individual, formal teaching and informal learning processes”. The authors contend that these elements “form an interactive whole in which the physical learning environment plays a central role… it should be analysed and developed holistically” (2011, p. 2). While acknowledging the difficulty associated with identifying and measuring each element, they can be taken as further evidence of the influence of learning environments, as well as the type of environment required in modern teaching and learning.

The point of settlement on quality teaching and learning for this study rests on the ideas of the centrality of student experience (Dewey, 1997/1938), customisation of the learning experience (R. J. Campbell et al., 2007; Prain et al., 2014c), establishing authentic partnerships of mutual inquiry (Fullan & Langworthy, 2014) focused on achieving deep and transferable understanding within a technologically rich environment (Kuhn, 2011).

This prioritises the student-oriented, personalised, collaborative, and technologically oriented experiences occurring in spaces allowing for a range of engagement modes. This notion is present throughout the BEP recommendations (Department of Education and Training, 2005, pp. 21, 24, 29, 34 - 35).

Attempts by BEP schools to implement this model provided access to the enacted instances of quality teaching and learning in open plan settings missing from the literature. The schools’ various modes of implementation reveal a dynamic interplay amplifying teacher and student agency through increased frequency and intensity of interactions. Teacher practice creates and is shaped by the settings and structures established to create quality teaching and learning.

Twenty-first century students

Students of the twenty-first century are unmistakably a product of the technology-saturated society. The flaws inherent in naming an entire generation aside, the labels for students in the second decade of the century are revealing: *digital natives* (Prensky, 2001), the *App generation* (Gardner & Davis, 2013), and variations such as *iGeneration* (Rosen, Carrier, & Cheever, 2010), *Net Generation* (Oblinger & Oblinger, 2005), *Generation C* (for content: creation and sharing) or now *Generation G* (for generosity) (http://trendwatching.com), and *Gen wi-fi* (Whitby, 2013).

Students are portrayed as wired or digitised with some future-thinkers predicting the integration of technology and biology (Greenfield, 2004). This latter set of ideas remains on the fringe but indicates the perceived momentum and an imaginable direction variously presented as utopic and dystopic.

The time-stamped *neo-millennial* tag is also popular in much of the literature. Though this label, along with *twenty-first century learners/students*, has avoided stitching technology into the name itself, it is clear that students of this century must contend with a technologically rich life. This context has consequences for skills and knowledge, personal development and pedagogical understandings.

There is recognition that twenty-first century students will require skills particular to the technologically rich dynamic (Dede, 2010; Fullan & Langworthy, 2014; Kuhn, 2011; OECD, 2006a, 2012; Philip & Garcia, 2013). The modern context demands an ability to "access, synthesize, and communicate information, to work collaboratively across differences to solve complex problems, and to create new knowledge through the innovative use of multiple technologies" (Ledward & Hirata, 2011, p. 4).

The instances of operationalizing curriculum exploiting technology in the open plan settings provided scope to examine pedagogies attempting to establish

collaborative and creative learning moments. These moments required schools and teachers to conceptualise practices beyond the traditional model. In turn, this impacted teacher practices and how teachers (and schools) considered the work of teaching.

Twenty-first century knowledge and skills

Knowledge has also undergone reformation in the modern context. Technology has the scope to democratise knowledge in that content is easily accessed and just as easily shared. Technology provides access to centuries of content. A solution to the potential for superficiality is deep learning. Deep learning aims for more than content mastery and moves toward creating and using new knowledge (Fullan & Langworthy, 2014). Indeed, the revision of Bloom's taxonomy saw 'creation' elevated to the peak of the higher order thinking strata (Anderson & Krathwohl, 2001).

The OCED published the *Definition and Selection of Key Competencies* (DeSeCo) project as part of the framework for ongoing PISA assessments (OECD, 2003). The final report (Rychen, 2003) identified key competencies in this dynamic, globalised society. The attempt to identify core principles of competence across diverse countries and cultures raises issues of contextual application but also reveals the unity of twenty-first century citizens and the challenges they face. Rychen (2003) offered three competencies as an "interdependent ensemble" (p. 85): interacting in socially heterogeneous groups; acting autonomously; and using tools interactively (p. 83).

Similar skills and knowledge are suggested throughout the literature with most articulations bearing similarities to those articulated above. There are differences of emphasis between the OECD and P21, for instance, (http://www.21stcenturyskills.org) but the core remains the same (Dede, 2010). Variations of expression and emphasis include elements such as fluency in media, critical media literacies or digital literacies generally (Dede, 2005; Kellner & Share, 2005), tool mastery and learner awareness (Philip & Garcia, 2013), expression through non-linear or non-algorithmic representations (Dede, 2005; D. Edwards et al., 2014), and similarly learning to learn (Fullan & Langworthy, 2014) present in the meta-cognitive assumptions of DeSeCo's autonomous student (Rychen, 2003).

The instances of interpreting curriculum in the BEP open plan settings were a response to requisite skills as outlined in the literature. The lived experience offered an occasion to examine the mechanisms leveraged to achieve this goal. Subsequently, the impact on teacher practices was identified. The research revealed a close link between understanding of necessary skills with interpretations of student and teacher knowledge.

Corporate influence in twenty-first century education

Corporate organisations are recognised as exerting an influence in education on the issue of skill identification and building, as well as leveraging influence on pedagogy and learning tools through involvement with technological development (Dede, 2010). Examples can be seen in the involvement of firms such as Microsoft, Apple and CISCO in international scale and local education initiatives. The economic incentive for their presence is easily understood. Moreover, the broader synthesis of goals in education governance and ICT is also made obvious.

There is a presence in broader media for promotion and soft-promotion services. These take the form of web-based communities who act as quasi-researchers often fronting for services or products. The presence of commercially geared enterprises in education is often easily identified and it is acknowledged that they exert an influence within and beyond the academic literature (Hogan, Lingard, & Sellar, 2015). The use of such sources within this literature review is carried out with circumspection and candour.

Twenty-first century students: uncertainty, fluidity, and control

The impact of the twenty-first century on understandings of the learning process has also been felt. The information age is coupled with immense change, uncertainties and pressures to assume a level of control hitherto not demanded of students. The consequence for education is that learners are increasingly recognised as existing in a transitional state (Sagan, 2011).

The simultaneous pressures of collaboration and creation, social learning and autonomy, informal and formal learning are recognised as occurring in and establishing a set of conditions that require students to exist in a state of fluidity and becoming (R. Barnett, 2007; Sagan, 2011). A dominant view is that learning occurs in a transitional or liminal state with an apparent nomadic or never-ending learning journey (R. Barnett, 2011; R. Edwards & Usher, 2000).

Literature in this area is often focused on tertiary settings. It is uncontroversial to assert that the twenty-first century learning experience permeates beyond post-compulsory schooling. Thus, the insights from the literature ought to be considered where an argument for their salience to the study can be made.

Theorising around learning in this context has led to the prominence of space as an organising concept. Space is considered as both a metaphor and a material construct. The current treatment refers to the conceptual considerations but it is recognised that the term 'learning space' is easily, and often, used as synonymous with 'learning spaces' (R. Barnett, 2011). The impact of each type of space on the other is reviewed later in this chapter.

Conducting a meta-ethnography Savin-Baden, McFarland, and Savin-Baden (2008) characterise such learning zones as disjunction, particularly where attempts at educational innovation were present. The authors acknowledge an ongoing consideration of such learning spaces in the literature.

Perkins (1999) offers 'conceptually difficult knowledge' or troublesome knowledge in a constructivist framework as potentially generating uncertainty and bewilderment. Other conceptions of learning space carry a similar tone: unsettling or risk (Savin-Baden, 2008), and are often linked to threshold concepts (Cousin, 2006). The inheritance from Vygotsky (zones of proximal development), and constructivism generally, is clear and regularly acknowledged.

A point of convergence can be seen in the conceptualisation of twenty-first century students as *produsers*. Bruns (2006) offers such students as *producers* and *users*. The most obvious examples of existing structures linking such students are shareware platforms and user-generated sites such as Wikipedia. The inheritance of the active, social, creator-learner in constructivism is easily identified.

The *produser* is not overly represented in the literature; however, the general characteristics are consistent with the existing notions of twenty-first century skills: user-led content production; collaborative engagement; palimpsestic, iterative, evolutionary development; alternative approaches to intellectual property; heterarchical, and permeable community structures (Bruns, 2006). This description provides a further reference for the type of skills and activities relevant to the twenty-first century setting.

The BEP schools identified as relevant cases offer teaching and learning philosophies consistent with the active, knowledge-maker found in the literature. The schools focus on personalised learning with students as active participants in the learning process. Despite the general nature of the philosophy or vision, the intended link to developing practices building twenty-first century skills is apparent.

The twenty-first century context places students in a unique situation where they are recognised as engaging with education as collaborative autonomous producers of knowledge. The ICT rich environment offers challenges and opportunities. This has consequences for their daily lives and identity.

Constructing identity in an ICT enabled world can be liberating and confining. Psychological literature is not in the scope of this study but of particular relevance to education generally is the inherent strengths and weaknesses of a virtual existence.

A focus on identity formation, intimacy and imagination sees a full spectrum of views emerging as to the impact and merit of technology, especially that which is personal and pluralised (Gardner & Davis, 2013). Potential problems such as forming an

unattached or unrealistic virtual identity are juxtaposed with the idea that a virtual identity provides time to consider one's identity and be more deliberate and thoughtful. Likewise, a virtualised or app-centric intimacy may be superficial or release you from geographic confines. Imagination, too, may be enhanced through exposure or made redundant in the face of information overload.

The deficit reading of a technologically saturated individual is well represented. It comes complete with dire predictions of dumbest generations (Bauerlein, 2008), isolation (Turkle, 2011), addiction, bullying, and dangers from sexual predators (Boyd, 2014). Notwithstanding some of the real dangers identified, it is enough to recognise the risks and further cement the role of schools in developing learners with skills to navigate this environment.

The five minds model offers a response to the pressures of high modernity. The minds equate to the set of skills and competencies generally accepted as desirable in the twenty-first century: disciplined, synthesizing, creating, respectful, and ethical (Davis & Gardner, 2011; Gardner, 2009). The psychological literature here is enough to orient the study for an overview of the student profile. A detailed response to the question will necessarily involve greater input from understandings of learning and a theoretical lens orienting teacher expertise.

Far from being an easy lure or panacea for a lack of engagement, technology complicates the education setting. The promise of technology is an empty one if it is considered without pedagogical context and curriculum intent (Philip & Garcia, 2013). Likewise, the consideration of learning space and learning spaces must be a response to the contemporary context.

Where the literature surrounding technology in education has a sound conceptual coverage of intent and scope, and the broader education sphere offers technical (often commercially geared) solutions and manuals, there remains a gap in the area specific to implemented strategies. The messy, unresolved, agent-focused, ICT-rich

open plan schools offered an opportunity to consider the impact of technology in conjunction with innovative curriculum programs.

The selection of case study sites is partially based on the schools' attempts at marrying technology to an innovative curriculum program to establish rich teaching and learning. The impact of this attempt on teachers is the key focus of this study.

Twenty-first century teachers

Taking the developed picture of quality teaching and learning as the lead (student-oriented, customised, authentic mutual inquiry, deep learning, and technologically rich) it is clear that a new or updated image of the teacher must emerge as well. Add to this the particular context of open-plan learning environments with a deliberately disrupting agenda for teaching and learning and curriculum programs and the demands on teachers are increasingly complex.

An attempt to isolate technical pedagogical manoeuvres, or university entrance quality, or technological competence will be resisted at this juncture. The core concern here is about understandings of teaching in the contemporary context. What are the implications of the twenty-first century context for teachers? Further, what settlement can be reached on the types of things teachers will be doing and will need to be good at to achieve success in these settings?

The shift to student-oriented learning has placed a premium on authentic experiences. Teachers are no longer transmitters of content for passive vessels. The shift away from a strictly outcomes-based, 'telling and testing' paradigm is fuelled by the recognised limitations of this mode of thinking within the current context (Aitkin, 2011; Alfieri, Brooks, Aldrich, & Tenenbaum, 2010; Darling-Hammond, 2006; Prensky, 2010; Whitby, 2013). Further, the advances in technology and its ubiquitous presence fundamentally alter the traditional role of the teacher. Where once the teacher was the knowledge-holder and the content-authority, technology and resultant attitudes have shifted the fundamentals (Fullan & Langworthy, 2014; McGregor, 2004a).

Fullan and Langworthy (2014, p. 3) assert that the shift in focus from the previous century – teacher as content provider/content delivery – has resulted in teachers needing to develop pedagogical expertise. They assert "the foundation of teacher quality is a teacher's pedagogical capacity – their repertoire of teaching strategies and their ability to form partnerships with students in mastering the process of learning".

The general shift toward pedagogical mastery is reflected in the literature. Recent publications have focused on identifying specific strategies with an evidence trail verifying efforts through student results (Hattie, 2009; Marzano, 2003). These studies offer a broad coverage of teacher practice. Where their focus on the importance of pedagogical expertise is instructive for teacher impact generally, and can be seen elsewhere (Connelly, Clandinin, & He, 1997; Darling-Hammond & Bransford, 2005; Good & Brophy, 2008; McInerney & McInerney, 1994; Valcke, 2013), a more context-specific assessment is required.

Teacher instruction manuals generally cover a range of educational psychology and concrete strategies with little focus on a close reading of the twenty-first century context. Most cover ICT but are often limited to building ICT into existing strategies such as group work or student-based research (Killen, 2009; Krause et al., 2010).

Discipline or subject specific texts may recognise the impact and power of ICT within specific frames and the impact of constructivism generally can be seen in strategies such as inquiry-based learning, but there is little ostensible concern for authentic inquiry or creating new knowledge (Gilbert, 2004; Marsh & Hart, 2011). To some extent this is explained by the recognition that the move to new or adapted pedagogies and the resultant consequences for teacher training is just commencing (Deed, Cox, & Edwards, 2014; Fullan & Langworthy, 2014; Prensky, 2010). Further, the specific context of open plan settings is unique and nascent practice is only just revealing emergent adaptations (Alterator & Deed, 2013; Boys, 2011a; Prain et al., 2014c; Whitby, 2013).

More recently there has been coverage in texts engaging with the issue of teaching twenty-first century students broadly (Prensky, 2010) and in engaging with specific tools such as mobile phones (Kolb, 2008) or web-based applications (K. King & Gura, 2007; Richardson, 2006). These texts offer something of more substance for understanding and examining teachers in a twenty-first century context but can become technical and bland as in the latter examples.

A further sweep of material reveals a range of texts covering the impact of twenty-first century context on teachers. There are preparation manuals and toolkits available from the OECD and corporatised product developers generally based in the United States such as Blackboard (http://anz.blackboard.com) and Educational Technology and Mobile Learning (http://www.educatorstechnology.com). The reach of Pearson is seen across the world (http://www.pearsoned.com) and increasingly in Australia (Hogan et al., 2015). Again, these are often technical in nature. They are instructive in that they tend to focus on strategies for teaching for creativity and collaboration but do not approach the level of complexity required to produce the quality outlined above.

Teachers in open plan learning spaces

There is a growing body of literature emerging that have scrutinised open plan learning spaces within the BEP or from similar scenarios. While the collective focus has not been on the impact of the twenty-first century setting on teachers, much can be garnered from the studies.

These studies draw on practice occurring in the complex, open-plan, up-scaled learning environments as identified in the case studies for this research. The studies provide an opportunity to identify salient data and emergent insights.

One of the dominant themes emerging from the BEP specific literature is teacher adaptation. Inherent in this thematising of the setting and program is the understanding that teacher practice and student behaviour is changing from traditional modes. Through an examination of attempts to implement personalised learning and in

monitoring teacher practices in response to altered arrangements – adaptation – emergent insights have been identified.

Personalised learning is evident in the literature (M. Fielding, 2004b; Mahony & Hextall, 2009; Prain et al., 2013; Prain et al., 2014b) and has been promoted by educational systems in Australia and the UK (Council of Australian Governments, 2008; DfES, 2004). Criticism in the literature has been aimed at definitional vagueness and "conceptual fuzziness" (Prain et al., 2014b, p. 45) with a resultant lack of clarity around teacher competence in this area.

Prain et al.'s (2014b) conceptualisation and plotting of the enactment of personalised learning offers a lead in identifying the sort of response required of teachers occupying this context. Relational agency (A. Edwards, 2005) is offered as the organising concept for teachers working to achieve personalised learning. Relational agency is the capacity of professionals to develop networks of expertise with common knowledge developed through shared practice (A. Edwards, 2011). Prain et al. (2013) recognise relational agency as present between teachers and teachers and teachers and students.

Relational agency is seen as salient as it is within this framework that teachers develop expertise that can identify and address the needs of individual students in order to increase the independence of students (Prain et al., 2014b). Clearly, the earlier call for pedagogical expertise is echoed here.

Emergent insight # 1

The conceptual rigour of Prain et al. (2014b) provides an insight for further examination: what are the instances of relational agency that will provide insight to teacher skills in the open plan settings?

Teacher adaptation is recognised as pivotal to understanding the responses to the BEP context. It is recognised in the BEP specific literature as conceptualising and actualising altered practice. Teacher adaptation occurs when teachers adjust to

dynamic settings requiring a reimagining of practice (Deed, Cox, et al., 2014). Literature on teacher knowledge and practice, models of expertise, and development informs the understanding of adaptation.

The literature recognises the pressure associated with encountering new environments, particularly twenty-first century experiences characterised as complex, dynamic, disorienting or disjointed (Cherry, 2005; Deed, Lesko, et al., 2014; Usher, 2002). An argument for teacher adaptability in novel settings is readily established. Deed (Deed, 2015a) offers an explanation that neatly umbrellas the research on this topic.

> Teacher adaptation is conceptualised as an imaginative and dynamic (re)occupying of the open-plan learning environment, providing a bridging mechanism between narratives of the possibilities/constraints of prior experience and projecting and enacting alternative learning experiences. (Deed, 2015a, p. 27)

Teacher knowledge and reasoning is essential to understanding the nature of adaptations and in undertaking a close reading of practices to reveal emergent skills. The literature in this area is well established with an ongoing dialogue shaping the sophistication of understanding teacher knowledge as practical or situated (Ben-Peretz, 2011; Elbaz, 1981; Verloop et al., 2001), and subsequent models of development or change (Clarke & Hollingsworth, 2002; Fullan, 1993a, 1993b), leading to models of expertise that favour ideas of teachers as agile, adaptive practitioners immersed in learning communities (Hammerness, Darling-Hammond, & Bransford, 2005; A. Hargreaves, 2013; Prain et al., 2014a; Sternberg & Horvath, 1995).

Theorising around adaptation is closely linked to teacher learning or knowledge development and is characterised as cognitive. This is generally understood to be a mix of changing beliefs and practice through engagement with external stimulus and subsequent application or experimentation through practice (Borko, 2004; Clarke & Hollingsworth, 2002). Adaptation is also theorised as occurring as a mix of knowledge

development and action (Deed, 2015a). Such models of adaptation are focused on the cognitive domain, though the addition of practical knowledge has seen the elevation of agency through action.

Consistent in the literature is the observation that adaptation is predicated on the idea of teacher agency and that adaptations are instances of agency (Clarke & Hollingsworth, 2002; Deed & Lesko, 2015). In other literature the centrality and necessity of agency is implied but evident nonetheless (Hammerness et al., 2005; Schwartz, Bransford, & Sears, 2005). Further, adaptations are understood as developmental and collaborative (A. Hargreaves, 2013). They must also balance the existing routines of teaching with the deliberate, reasoned choices in response to altered conditions (Deed, 2015a). Though these models offer a nuanced account of adaptation, they remain grounded in the cognitive domain. Adaptations remain linked to the individual's theoretical or knowledgeable response even when realised through a practical expression.

The theorising of adaptation has undergone changes to accommodate shifts in understanding teacher knowledge as practical and the subsequent elevation of teacher agency. The teacher adaptations required in open plan environments are unmapped. An examination of the practical adaptations and the relevance of existing theoretical accounts can occur as part of the consideration of data. In particular, this study will consider the impact on teacher adaptation in the overtly disruptive setting of open plan schools.

A further conceptualisation of the practice within the BEP open plan settings is provided by Prain et al. (2014a). The emerging patterns of work are seen as opportunities for refinement of existing practices and adoption of new opportunities. This is understood as work occurring in a threshold of change. The threshold of change hinges on agentic response and is monitored through reflexivity. The perception and response are based on a range of affordances. Importantly for this study, these are categorised as primary or secondary affordances. Where the examples provided in the model relate to the open plan sites of the BEP, this study responds to the data collected

through interviews and observations of practice. These include temporal, spatial, symbolic, expedient or principled affordances (2014a). Importantly, the model attempts to represent the complex, unpredictable and changing centre of agency as individuals and teams respond to circumstances.

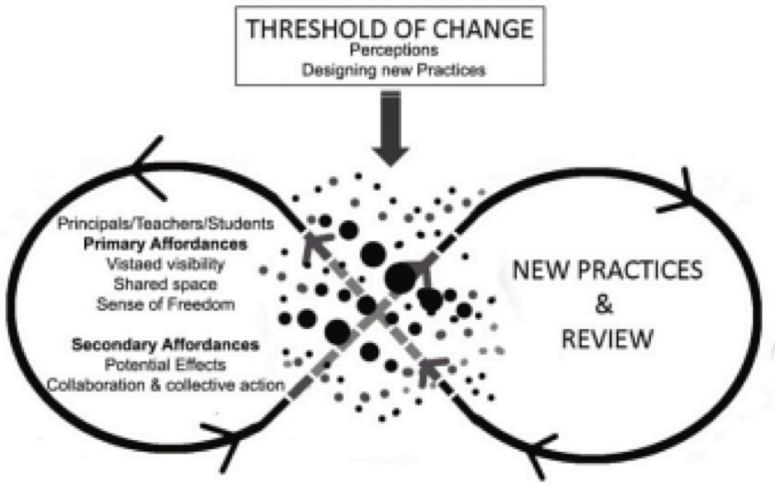


Figure 1. Threshold of change. V. Prain et al., 2014, New practices, new knowledge and future implications for learning in open-plan settings for low SES students. In V. Prain, P. Cox, C. Deed, D. Edwards, C. Farrelly, M. Keeffe, V. Lovejoy, L. Mow, P. Sellings, B. Waldrip, & Z. Yager (Eds.), *Adapting to teaching and learning in open-plan schools*. Rotterdam, The Netherlands: Sense Publishers. p. 203.

This research revealed the open plan settings produced an amplification of the factors outlined above. Teachers were required to divest traditional notions of authority, participate in highly collaborative, visible spaces, be flexible in practice and open in beliefs about the affordances/possibilities of the open plan spaces for daily practice and curriculum structures (Alterator & Deed, 2013; Deed, 2015a; Deed, Lesko, et al., 2014; Lovejoy, Mow, Edwards, Waldrip, & Prain, 2014; Prain et al., 2014a).

Emergent Insights 2 - 5

The case for teacher adaptation is clear and provides a further lead for this research: what are the instances of practice that reveal the skills necessary for successful teacher adaptation in open plan learning settings?

What are the affordances of open-plan settings (and what is the relationship between affordances and teacher beliefs)?

What understandings of teacher knowledge best allow for adaptation in the open plan settings and inform the emerging picture of teacher skills in that context?

What are the instances of adaptation as agency seen in the practice of teachers that inform the identification of teacher skills?

Literature examining education of the twenty-first century reveals changed conditions for students and teachers. The goals of customised learning experiences within a constructivist frame, along with technological advances and the subsequent impact on knowledge (access and creation), combined with developments in pedagogical understandings, establish a dynamic set of conditions for investigating teacher practices. The open-plan setting of the BEP schools further amplifies the demands on teachers within a dynamic, complex arrangement.

Generative insights have been established that provide prompts and leads for further framing the theoretical chapter and in shaping data collection and analysis.

Context for change

This section locates the open-plan settings within a context for change and explores the architectural influence on the realisation of a new paradigm within education. In particular, the influence of theoretical understandings of space and its role in learning and design are extrapolated.

The latter part of the twentieth century saw a growing recognition of the role of physical space in reforming education practice (David & Weinstein, 1987). The twenty-first century context has seen an expansion of the deliberate attempt to use learning spaces to influence teaching and learning (Department of Education and Early Childhood Development, 2008; Department of Education Employment and Workplace Relations, 2012; OECD, 2006a). Indeed, the idea that space *has an impact* is characterised as axiomatic, or is recognised as well known (McGregor, 2004b; Melhuish, 2011).

Further, the open plan learning spaces combine with customisation, collaborative practice, and ICT to form an alternative to the industrial-era paradigm (Deed & Lesko, 2015; McGregor, 2004b; Melhuish, 2011). The BEP is a large-scale single-town response located within this reformist frame. Emergent insights will be taken from the literature to guide data collection and analysis.

The genealogy of contemporary schools and classrooms can be traced to the Industrial Revolution. The inadequacies of such structures – architectural and organisational – in addressing the challenges of modernity are well established (Gislason, 2010; Kuhn, 2011; McGregor, 2004b; Scott-Webber, 2004; Whitby, 2013).

The cellular classroom was designed to establish and emphasise authority. Students were expected to be obedient and docile (Nicholson, 2005). It readied pupils for an age requiring a compliant workforce (Aitkin, 2011; Kuhn, 2011; Markus, 1993). The application of these principles produced buildings – and arguably learning experiences – of uniform size and shape (Scott-Webber, 2004). Nicholson (2005) described the buildings as cold and forbidding. Characterised as 'mass education', these facilities housed rows of desks, assertively positioned teacher dais, and central blackboard. The formulaic set-up has long been present in education settings with Barnard reporting the basic orientation in a review of American schools in 1848 (Barnard, 1848). Oftentimes, the symbolic subordination was accompanied by the literal

subordination by means of positioning female and naughty students to the sides or rear of classrooms and in the form of corporal punishment (Aitkin, 2011, p. 25; Kuhn, 2011).

The various pressures working on education – history and policy of class size, as well as industrial ideals – are cited as contributing to the industrial-era norm. Further, social preferences also played a role (Hutchison, 2004; Jilk, 2005). Dudek (2000) suggested that while the twentieth century saw some radical ideas in education, there was an equally strong conservative current. According to Dudek, the private school tradition maintained an approach "where strict hierarchies were reflected by an architecture which changed little within the intervening decades of the nineteenth and twentieth centuries" (2000, p. 1). While public education experienced some radicalising, the progressive ideas of thinkers such as Steiner and Montessori did not come to dominate education. Moreover, their influence within architecture is the exception, not the norm.

Need for altered arrangements

The designs of the BEP schools are consistent with ideas underpinning schools for the Knowledge-Age. Open plan designs have come to represent and embody the fluid, open-ended education experience understood as central to twenty-first century learning and to provide the flexibility required to disrupt or shift practices (Boddington & Boys, 2011; Gulson & Symes, 2007).

McGregor (2004b) asserted that although schools aspire to become learning organisations and accommodate the knowledge economy, the majority fall short. Instead, they "exhibit physical, organisational and social arrangements that have changed relatively little in the last 150 years" (p. 13). Dewey described the traditional schoolroom as militaristic, restricting freedom of movement and intellectual endeavour through "straightjacket and chain gang procedures" (Dewey, 1997/1938, p. 61).

The tension within schools becomes clear when it is acknowledged that classrooms are routinely and accurately described as “busy, multifaceted, culturally invested and changing” (Hattie, 2009, p. 4). The tension is further illustrated in the generally accepted observation that the practice of teaching has changed very little over the previous 100 years. The constants are readily identified: “the age-grading of students, division of knowledge into separate subjects, and the self-contained classroom with one teacher” (Hattie, 2009, p. 5). Further, McGregor (2004b) acknowledged that “schools as hierarchical, routinized and highly structured environments contrast with the world ‘beyond’ school… which is obviously complex, layered and presenting constantly changing challenges” (p. 17).

The established routines of the industrial-era paradigm are at odds with twenty-first century understandings of quality teaching and learning. A system of teacher-authority, subdued students and overt power structures does not match with attempts to establish student-oriented, personalised and authentic learning experiences in a collaborative, ICT-rich environment.

The BEP is a deliberate attempt to disrupt the established paradigm in favour of the twenty-first century experience. In this way it is a realised instance of the conceptual understanding. This research is a multiple-case study, close reading of the lived experience of attempts to invert the industrial-era practices.

Role of space

The understanding of twenty-first century learning informed by constructivism as interactive, student-oriented and mediated through social interactions has influenced understandings of the nature and role of physical learning spaces. Likewise, the understanding of space has shaped the understanding of how learning environments might be constructed.

In particular, the concept of spatiality – social construction of space – allows for schools to be read as an ongoing interaction between space and practice (McGregor, 2004a). Space is seen as essentially relational (R. Edwards & Usher, 2000; McGregor,

2003a) or political with textures of power and authority (Hofbauer, 2000). The seminal work of Lefebvre (1994/1974) and Massey (1994) allowed a spatial turn reinstating space in a post-Cartesian ontology that has influenced work in this area (Boys, 2011a; Gulson & Symes, 2007; Massey, 2005). In this way space is both a construct and relative as distinct from given or absolute (Gulson & Symes, 2007).

The acceptance of learning as transitional or liminal – consistent with constructivist educational theory – means learners negotiate their way through particular/localised boundary conditions (R. Barnett, 2007; Boys, 2011a). This implies that students are in a constant encountering with new knowledge that has the power to unsettle or create uncertainty (Cousin, 2006; Sagan, 2011). This rests on the acceptance of self as shifting and contingent as opposed to ideal or essential (Sagan, 2011).

Sagan (2011) acknowledged that such states exist as a result of interactions: "It is constructed through the beings in it, and through the messages, signs, symbols, texts, images and discourse which pervade it – from and between these subjects with their attendant positions" (p. 75).

Consistent with the idea that space is not static or settled (McGregor, 2003a), but created through occupation and resultant interactions and mediated by technology and other artefacts (McGregor, 2004c) Sagan (2011, p. 76) suggested an institution – both in physical space and curriculum design – that contains a capacity for "ambivalence and anxiety, and allows for digression, dissent, mess".

This emerging understanding of learning means:

> …space is not so much a metaphorical expression or setting for learning, as one of the (many) mechanisms through which contested ideas about what learning is or should be are articulated – both in offering up 'pictures' of potential new repertoires, and 'making concrete' the preferred repertoires of particular communities of practice. (Boys, 2011a, p. 122)

A new paradigm

In contrast to hierarchical and highly structured environments of industrial norms, open plan buildings embody the general shift toward "free-flowing, 'loose fit', multi-purpose environments, which encourage individual creativity, social interaction and the confidence to shake off mental straitjackets and develop exploratory thought processes" (Melhuish, 2011, p. 22).

This insight is reflected in the literature generally (Barret & Zhang, 2009; Boys, 2011a; Deed & Lesko, 2015; Oblinger, 2006). The impact of contemporary understandings of learning has influenced the way space is considered in learning institutions at all levels (Bennett, 2007; Boys, 2011a; Brooks, 2011). This can be generalised to student-oriented, agent-oriented, creative and engaged with relevant technologies (Aitkin, 2011; Savin-Baden, 2008; Upitis, 2004).

Architectural influence

Architectural understandings have influenced the development of school design through conceptualising the role of built space in achieving twenty-first century learning. The built environment is also seen as provocateur or disruptor (Department of Education and Early Childhood Development, 2008; Oblinger, 2006). This is in line with the understanding that changes to schools and practice for the twenty-first century is transformational (Mahony & Hextall, 2012).

Considering the large-scale investment in school renewal in Australia and across the Western world, what can be said of the influence of architecture? What are the signs of influence or what are the conditions for gain in the innovative settings?

The influence of architecture in education has prompted several governmental and institutional literature reviews and reports. A set of assumptions about twenty-first century learning, consistent with those outlined above, is generally present. There is a body of literature occupied with post occupancy evaluations. These studies usually examine a range of environmental factors and report favourable relationships between light, air temperature and student comfort, but also recognise the limits of drawing

causal links to academic performance (Higgins et al., 2005; JISC, 2006; Moore & Lackney, 1993; OECD, 2006b).

Other publications report on designs that are illustrations of underlying architectural or educational assumptions (Barret & Zhang, 2009; Department of Education and Early Childhood Development, 2008; OECD, 2006a) and make similar calls for further research. The literature reviews are instructive in that they identify similar weaknesses in reports and much of the literature: lack of empirical evidence and lack of foundation in school contexts (Blackmore et al., 2011; Cleveland & Fisher, 2013; Higgins et al., 2005; Woolner et al., 2007).

This indicates potential limits for research and indicates the need for the research conducted by this study. While physical components are recognised as important, they are not the focus here. The enacted instances of teaching and learning provide a meaningful picture in addressing the research question.

Assessing open plan settings: limitations to post occupancy evaluation

There is a small but growing literature developing post occupancy evaluation tools that examine the link between physical environments and teacher practice. These too are limited in scope and reliability. The tools are empirically based and often user-generated but lack any genuine scope for drawing conclusions beyond affirming intuitive assumptions. For instance, Fielding Nair's (R. Fielding & Nair, 2005) tool Educational Facilities Effectiveness Instrument (EFEI) employs an extensive questionnaire that can be criticised as being summative.

The CELE (OECD, 2006b) provided an organising framework for assessment of learning spaces but acknowledged the inherent complexity and associated difficulty in drawing conclusions beyond material impacts. Lee and Tan (2011) also identified an inherent complexity and their literature review identified phases for ideal assessment junctures with an acknowledgement that existing tools were inadequate.

In their extensive review of the literature on learning spaces and student outcomes Blackmore, Bateman, O'Mara, and Loughlin (2011, p. 12) identified scarcity of empirical research as well as a lack of studies exploring the complex relationships between "organisational planning, school culture and leadership, the use of learning spaces, and student academic outcomes".

The need for empirically based, in-depth readings of open plan learning spaces that recognise the complexity of such environments is echoed in other parts of the literature (Bligh & Pearshouse, 2011; David & Weinstein, 1987; Gislason, 2010; Higgins et al., 2005; Lee & Tan, 2011; Temple, 2008; Woolner, 2015) with others employing 'case studies' to illustrate conceptual assumptions (Dudek, 2000; Nair, Fielding, & Lackney, 2009).

Despite the limited empirical evidence there are various authors/report committees prepared to offer a set of principles for designers with reference to learning settings (for instance see Jamieson, Fisher, Gilding, Taylor, & Trevitt, 2010; JISC, 2006). Fisher (2005) offers a schemata linking pedagogy and space that recognises the complexity of the learning setting. Yet, the principles appear to be activity containers and are reductionist as opposed to transformative.

Developing principles seems fraught when offering anything beyond general ideas. The corpus simply does not warrant the development of principles and, at least at this point, ought to be content with guiding assumptions. Moreover, the literature reveals a need for educators to inform the development of design principles based on pedagogical requirements (Bligh & Pearshouse, 2011; Jamieson, 2003; Temple, 2008). This is complicated further by the emergent status of practice in addressing twenty-first century needs and the contested nature of teacher practice in open or non-traditional learning spaces (Deed & Lesko, 2015; Woolner, McCarter, Wall, & Higgins, 2012).

The literature indicates that identifying the signs of influence is limited due to a lack of empirical evidence. This is particularly the case in relation to identifying learning spaces creating fertile conditions for gain through relationships between space,

curriculum and practice. Significant literature reviews and academic research consistently point to the need to recognise the complex nature of the settings and for close examination research to furnish the limited understanding.

Literature employing longitudinal studies, close-case analysis, and or cross-case methods move beyond affirming the broad assumptions about design and space use. Further, they meet the challenge of basing conclusions about space and practice on empirical, school-based research.

This study employed empirically based case-study methodology to examine the enacted instances of practice in open plan settings. This positions the work as capable of drawing links between emergent practices and the impact of open plan learning environments.

Assessing open plan settings: Examining emerging close-case, fine grain studies

The longitudinal study of the BEP by Prain et al. focused on personalised learning (2013) and teacher adaptation (2014c). Work stemming from this three-year project covers areas in restructuring teaching (Cox & Edwards, 2014), technologically-mediated spaces (D. Edwards et al., 2014) and teacher adaptations (Lovejoy et al., 2014). The study also explored student voice in determining findings specific to learner effects.

Other literature use close analysis to draw a clearer link between space and teacher practice (Alterator & Deed, 2013; Deed & Lesko, 2015; Deed, Lesko, et al., 2014). Case studies are being increasingly used to verify or challenge the assumptions central to the broad literature on this area (Saltmarsh, Chapman, Campbell, & Drew, 2014; Woolner et al., 2012).

Other studies have taken the major themes of practice such as team teaching, co-teaching and collaboration as their starting point and employed close case analysis and/or cross-case method to establish empirically based conclusions on the specific practices (Childers & Lowry, 2004; Eick, Ware, & Jones, 2004; Jang, 2006; Welch, 2000).

It is noted that the practice-specific studies do not always occur in open plan settings; still, they are taken as empirically based academic research that may contribute to this nascent field.

Though the architecture-oriented literature in this area is recognised as varying in quality and method (Blackmore et al., 2011; Cleveland & Fisher, 2013), this study recognises the influence of the discipline in characterising school environments and contributing nomenclature specific to recent innovations. Architecture has contributed conceptual understandings of design that attempt to capture the spirit of twenty-first century learning. Openness has dominated this thinking in architecture and education. It is seen to rest on ideas of physicality: physically open, less defined spaces (Barret & Zhang, 2009); and from the social realm: democracy, freedom and community (Deed & Lesko, 2015).

Openness has led to the development of a range of metaphors that serve architecture and education simultaneously: flexibility (JISC, 2006; Oblinger, 2006 and others), finished beginnings (Barret & Zhang, 2009), uselessness, and montage of gaps (Jilk, 2005). Other, less metaphorical conceptions play a similar role: co-authored spaces (Boys, 2011a; Dudek, 2005), action possibilities, permanent but incomplete (Jilk, 2005). Leiringer and Cardellino (2011) noted that the school is not completed when the building is.

Even here, the strength of such conceptualisations can be criticised for an apparent lack of substance. Each of the metaphors has an inherent emptiness. This emptiness leaves educators, curriculum designers, and teachers to add meaning through practice. The criticisms of Temple (2008), Jamieson et al. (2010), Gislason (2010, 2011), and others, remain unaddressed. Further, the scope for new representations of architectural intent and occupancy may be generated.

A concession can be made in that this emptiness can be justified as the intent of such metaphors. While the concepts carry an influence in design it is recognised that learning environments are only provided with meaning once occupation and practice

occurs. The question remains: *what are the conditions for gain as realised in open plan settings?*

Conditions for gain can be read as instances of practice occurring in open plan settings. The settings themselves are supported by a set of intuitive and broadly supported assumptions but the research gap is clearly in identifying the practices that respond to the setting to generate twenty-first century learning experiences.

Agency: Organising concept for understanding the productive disruption of open space

The treatment of agency within this understanding is noteworthy. Openness is seen to elevate student control (Melhuish, 2011) and suggests an importance to activating agency for teachers and students through interactions and relationships (Prain et al., 2013). This provides a lead in commencing to frame the conditions for gain and in determining the skills required of teachers in such a situation.

Agency is present at a theoretical level in architecture literature. Lippman (2010) contended that a sound response to modern needs is based on a transactional relationship where the learning environment is understood to be composed of learners, teachers and the physical environment. Likewise, Jilk (2005) recognised that learners are authors of their environments. Authority is shared between architect and consumer. Thus, students and teachers are empowered agents in a highly collaborative ensemble.

Authors attempting to theorise an intersection in architecture and education understand space to require use. Boddington and Boys (2011, p. xx) asserted: “space cannot be separated from its occupation”. This is consistent with Boys (2011a) who confirmed architectural space as “always in a partial interaction with the practices that take place in it” (p. 121). Such readings of space elevate the role of agent.

Savin-Baden (2008) understood the consequence of open, flexible, ‘smooth’ learning spaces to be that the creator of the space defines the learning space. This takes in various learning sites and spheres and is not limited to physical boundaries. The

importance of the agent in creating learning spaces – teachers and students – is conspicuous.

Theoretical concerns for open plan learning environments.

The understanding of the spatial turn, in particular, provides an opportunity to examine the theoretical concerns with open plan learning spaces. Overt power structures present in industrial-era school design are deliberately avoided in open plan settings; however, the core construct of power remains grounded in physical space.

> Besides materialising through the life of the body, the chief way in which power and bond relations are made concrete is through bodies in space; in the space of buildings and towns. (Markus, 1993, p. 25)

The panoptical gaze (Foucault, 1979/1975) is a metaphorical expression – following Jeremy Bentham's prison design - understanding that discipline and power is embedded in the system that works through a disembodied surveillance rendering compliance a necessary part of existing in society. In this way power relations overtly present in judicial and political structures are distributed through informal or implicit means (Foucault, 1979/1975; Schirato, Danaher, & Webb, 2012); "millions of little powers form the weft of society in which individuals form the warp" (Veyne, 2010, p. 94). The panoptical gaze asserts that power is exerted through created space-time in particular practices and knowledges (Flyvbjerg & Richardson, 2002).

The features of high visibility and easy monitoring along with potential for coercion may be tabled as criticisms of the open plan environment. Markus (1993, p. 94) asserts that the monitorial, class structured traditions have been replaced by convenient mechanisms: "without concrete spatial boundaries, surveillance by head teachers over their colleagues, and by the latter over children, became much easier".

Though the power mechanisms of industrial school designs have been shifted from corridors and raised platforms, they are present nonetheless. This is most obvious

in the panoptical parallel to the open plan design. This criticism sits within a broader concern of the dimensions of power in physical space and the workplace in particular (Gulson & Symes, 2007; Hofbauer, 2000). Open plan schools may intend to be collaborative and visible, but a reasonable account of the theoretical position is required.

Flyvbjerg and Richardson's (2002, p. 3) account of planning theory focuses a Foucauldian perspective on *power* as distinct from *oppression* and *coercion*. The authors assert that the insights of Foucault can be used in "productive ways to support the empowerment of civil society". Further, the authors assert that a healthy democracy allows for and legitimates conflict and understands power to be at the centre of its thought. The use of Foucault's insight in this way is consistent with the spatial turn that acknowledges power but is not overly restricted in an attempt to avoid it. Spatiality is the acceptance that social space is socially created. There is an acceptance of the power dimension and that this is a social product (Lefebvre, 1994/1974).

The dimensions of power within schools is recognised as a key influence on the organisation of space and time (Frelin & Grannas, 2014; McGregor, 2004b, 2004c). Architectural and pedagogical thinking has sought to understand and respond to these dimensions by establishing collaborative, democratic spaces emphasising interactions (Boys, 2011a; Deed & Lesko, 2015; McGregor, 2003a; Melhuish, 2011). This is not to be mistaken as an attempt to neutralise power relations or eliminate structures of hierarchy; rather, the intent is to manipulate the structures in the service of particular pedagogical outcomes; agency-enhancing structures geared toward student control over learning through engagement with space and personalised curriculum structures. The dimensions of power and the interplay between individuals and institutional structures are acknowledged. The reading of these elements of practice will be considered in light of the insights offered in Foucauldian theory.

This study is not attempting a Foucauldian analysis of open plan spaces; rather, the central insights on power inform the reading and response to particular criticisms. The theoretical account of open plan spaces offered for this study considers the reading

of power as central (Foucault, 1979/1975; Markus, 1993) and takes Flyvbjerg and Richardson's (2002) insight as an attempt to manipulate space in the service of learning goals.

The criticisms that open spaces generate scrutiny through heightened visibility and potentially generate visible and public power relations are recognised as important elements to consider in this study. On balance, however, the convergence of understandings of quality learning, use of resources (spaces and teacher expertise), and learning being mediated in multiple ways points to the justification of collective practice and meaningful alignment of resources.

Practical concerns of open plan learning environments

Practical criticisms of open plan schools usually centre on the lack of research examining the link between open plan learning environments and improvements to student performance (Blackmore et al., 2011; Cleveland & Fisher, 2013; Hattie, 2009; Higgins et al., 2005; Lee & Tan, 2011; Woolner et al., 2007). Links between the open plan context learning environment and teacher practices remain an under researched area (M. Campbell, Saltmarsh, Chapman, & Drew, 2013; Gislason, 2009; Jamieson et al., 2010; Saltmarsh et al., 2014). Taken together, the criticisms suggest the need for a model of assessment focused on the educational practices occurring in the open plan settings.

This study has focused on the particular concerns of each area of criticism as it is addressed in the review of the literature throughout this chapter. Of particular note is the emerging criticism of open plan learning spaces in the area of increased noise, student distraction and colleague behaviour (Hutchison, 2004; Saltmarsh et al., 2014). Similar concerns are emerging from professional fields recently adopting open plan office layouts (Baldry & Barnes, 2012; Kim & de Dear, 2013) with a litany of issues ranging from noise and distraction to illness and the erosion of professional identity. Where the perceived benefits of increased interactions and collaboration clashed with primarily individual work (as in the work of academics) the concerns were amplified (Parkin, Austin, Pinder, Baguley, & Allenby, 2011; Ryan, 2014). There are limited

parallels with open plan schools where there is significant alignment between intended pedagogical outcomes and the generally accepted impacts of open plan layouts.

Many of the criticisms in the existing education literature correspond to settings not engaged with innovative curriculum responses (Gislason, 2011; Higgins et al., 2005; Horne Martin, 2002; Saltmarsh et al., 2014). The school sites under scrutiny are often working in converted traditional school settings only partially open or operating traditional programs in open plan settings. The latter arrangement is almost certain to undermine the philosophical and pedagogical intentions associated with the open plan design principles.

This study has identified multiple innovative attempts at engaging with the open plan school setting. The study is capable of revealing the impacts on teachers where a greater degree of effort has gone into harnessing the potential of the space. The case study schools represent a genuine challenge to the industrial curriculum and architectural model. The focus is different by virtue of the program being an advance on the early responses outlined in the education literature.

The need for a model with which to assess the occupancy phase of open plan school settings is acknowledged. This study contributes a model capable of assessing the space with a particular focus on the reaction of teachers in service of the determination of the emerging skill set.

Agency: Understanding enacted instances of adaptations

Agency provides an opportune juncture bridging the conceptual plane and practical concerns. It is a recognised and rigorously argued concept that lends itself to a practical reading. In this way the enacted instances are central to the conceptual justification and orientation of this study.

Agency is understood as important to framing the adaptation of practice by teachers and students. Where new or adapted practices are afforded or encouraged by

non-traditional spaces and initiatives such as personalised learning, teacher and student agency is elevated (Deed, Lesko, et al., 2014). Agency is seen as providing a frame for teacher action within open spaces as the "potentially meaningful intersection between pedagogical and architectural narratives"(Deed & Lesko, 2015, p. 8). It is conceived as capacity of students and teachers to "act in ways that contribute to new learning" (D. Edwards et al., 2014, p. 93).

Attempts at conceptualising teacher adaptation have centralised the role of the agent. This is in keeping with open plan, student-oriented spaces that are designed to require co-authoring. Agency is identified as teachers making reasoned choices sensitive to the context for action (Deed, 2015a). The specific settings of open plan learning environments and set of conditions taking in school program, student cohort and teaching profile contribute to the detailed understanding of agency (Deed & Lesko, 2015).

The research in this area indicates the potent leads for areas of identifying teacher practices but stops short of a detailed account. Deed and Lesko (2015) touch on interaction in their case studies and Alterator and Deed (2013) examine interactions in a single case study. Prain et al. (2014c) have conducted a longitudinal study but a fine grain account of teacher practices sensitive to agency is missing.

Emergent insights

The literature specific to agency in open plan settings provides an opportunity to identify emergent insights. Further exploration into the instances of agency and the impacts on teachers as they attempt to establish quality teaching learning in open plan settings ought to yield results capable of revealing skills required of teachers. These can be framed as questions linking to the central research question.

Which moments of practice identify teacher and student agency?

How might we read the open plan settings as contributors to innovative practices?

What is the relationship between teacher responses to open plan settings and attitudes or beliefs?

Teacher Knowledge

A further consideration for this study is identified in teacher knowledge. A fine-grain examination of teacher agency and adaptation requires an understanding of factors impacting the enactment of practice. The literature in this area is extensive and the developing ideas of teacher knowledge can be traced against the developments in teacher professionalisation and organisational understandings across the twentieth century (A. Hargreaves, 1994; D. Hargreaves, 1980; Hatton, 1985; Lortie, 1969; Shulman, 1986).

In the last few decades there has been a gradual acknowledgment of the complexity of teacher knowledge. Academic conceptualisations have tended to attempt a compromise between content and process; that is, between discipline expertise and pedagogical expertise (Ben-Peretz, 2011; Grossman & Richert, 1988; Shulman, 1986).

More recently, academic literature contends that teacher knowledge is primarily practical and based in personal experiences of practice (Connelly et al., 1997; Elbaz, 1981; D. Hargreaves, 1997; Roth & Tobin, 2002). Cochran-Smith and Lytle's (1999) account offers knowledge *for* practice, *in* practice, and knowledge *of* practice. This conception accepts the teacher as knower and agent in the classroom as well as in broader educational contexts. Further, teacher knowledge is understood as belonging to and emanating from practice in communities (Darling-Hammond, 2006; Grangeat & Gray, 2008; Rogers, 2002).

Teachers' knowledge of theory is generally accepted as being tacit; however, it is acknowledged as an important part of teacher knowledge (Desforges, 1995; Verloop et al., 2001). Borko (2004) acknowledges the challenge of teachers representing this theoretical knowledge within the bounds of practice-based thinking.

This study avoids tags such as practical wisdom, craft-knowledge, or action oriented knowledge (Brown & McIntyre, 1993). While the immediacy of access and application is appealing in such articulations, it does not capture the inheritance of routines and continuity of discipline narratives present in schools.

Teacher knowledge as a mix of theoretical and practical knowledge

This study understands teacher knowledge is a mix of theoretical and practical knowledge expressed through practice. It is based on theoretical understandings that are often implied or hidden but the expression of that theory is found in enacted instances (Elbaz, 1981) made up of conscious opinions and intuitive responses (Verloop et al., 2001). Moreover, the ongoing routines of practice located in the context of the school are an important contributor to teacher knowledge.

Elsewhere, teacher knowledge is articulated as *practical inquiry*: seen when teachers engage in the process of considering ongoing practice and potential solutions to novel situations (Cochran-Smith & Lytle, 1999; Deed, 2015a). As teachers implement strategies in the altered environments of open plan schools, their thinking is expressed through their practice.

A range of methodology has been employed within the literature to determine and develop teacher knowledge. While theory plays a significant part in orienting research, the majority of studies utilise teacher testimony (narrative, case study) or detailed observations (ethnographies, field notes) to make determinations about teacher knowledge (Anderson-Levitt, 2006; Clandinin, Pushor, & Orr, 2007; Connelly & Clandinin, 2006; Fenstermacher, 1994; Nespor, 2006; Verloop et al., 2001).

The recognition of teacher knowledge as predominantly practical has seen a pragmatic understanding of knowledge emerge in the literature (Deed, 2015a). Conceptions of teacher knowledge as being *in* and *by* practice (Elbaz, 1981), *for, in* and *of* practice (Cochran-Smith & Lytle, 1999) along with various conceptions emphasising

practical knowledge aligns with the pragmatist epistemological insight that "subject and object merge in experience" (Mizak, 2013, p. 113).

There is a tension within the literature at the juncture between personal knowledge and collective knowledge. While the focus on personal expressions of knowledge is not inherently problematic, it is limited in its scope. There is a counter-idea that identifying shared knowledge can yield generalisations of knowledge common to all teachers (Brown & McIntyre, 1993). The issue of generalisability is considered as a methodological concern and treated in the method chapter.

The need for commonalities through shared knowledge is not to be confused with the development of relational expertise and distributed intelligence articulated in recent work by Anne Edwards (2005, 2011). The latter is articulated in detail in the theory chapter. This study takes testimony and behaviours of teachers as constituting data revealing their knowledge, beliefs and understandings.

Teacher knowledge and collaboration

Collaboration and collective practice within open school settings is overtly facilitated and inevitably intensified. While teaching is traditionally understood as a lonely profession (Rogers, 2002) that has institutionalised isolation (D. Hargreaves, 1980; Hatton, 1985), recent decades have seen a practical and theoretical shift. The shift in thinking and culture toward collaboration is consistent with a world where change is observed to be a "journey of unknown destination, where problems are our friends, where seeking assistance is a sign of strength, where simultaneous top-down bottom-up initiatives merge" (Fullan, 1993a, p. viii). Collaboration and collegiality more generally are seen as means of addressing the challenges of twenty-first century schooling (Department of Education and Training, 2003; Engestrom, 2008; Slater, 2010) as well as the cause of tension between the individual's autonomy and the needs and benefits of the collective (Fullan, 1993a; A. Hargreaves, 1994).

Recent discourse on teacher knowledge, practice and training has conceptualised teaching as a collective endeavour (Rico & Shulman, 2004; Shulman & Shulman, 2004; Smith & Sutherland, 2003). This situation posits the teaching scenario as complex with the blurring of horizontal and vertical structures of hierarchy and knowledge sharing (Grangeat & Gray, 2008). Teacher practice is thus understood as taking place in, and to be enhanced by, a learning community (Borko, 2004; Cochran-Smith & Lytle, 1999). Consistent with the practices occurring in the open plan settings of the BEP schools, interactions in communities of practice are more frequent and significant.

By such a reading, collective practice, jointly developed and shared, is conceptually aligned with relational agency and distributed intelligence (A. Edwards, 2005). The idea of distribution of knowledge and expertise has a heritage in conceptions of *common knowledge* (D. Edwards & Mercer, 2013) linked with non-transmissive, non-didactic teaching. It is expressed as mutuality or shared understanding with an assumption that knowledge is based in social relations and communication (A. Edwards, 2011; D. Edwards & Mercer, 2013).

According to A. Edwards (2011) distributed intelligence reads intelligence as outside the individual. It stretches beyond individuals and across systems to be accessed by practitioners. Physical and symbolic cultural tools embody or carry the intelligence and enhance action (A. Edwards, 2005). The focus on practical expression of knowledge gives rise to the distribution through artefacts and tools (practices) that in turn allows for the compounding of the system through collective practice.

Agency also assumes significance in the situation where interactions are a central feature of practice. This is in keeping with the reading of increased agency in constructivist, collaborative practice enabled by open plan settings encouraging student-oriented pedagogies. In particular, the concept of relational agency provides a theoretical lead. This will be explored in more detail in the theory chapter.

Framing collaborative practice and teacher expertise: Relational expertise

Expertise is a contested field. Epistemologically, the conceptual divide between practical and propositional knowledge remains unresolved (Fenstermacher, 1994). Models of teacher expertise have broadly followed attempts at systemising teacher knowledge with an initial focus on subject content moving to a more nuanced understanding of teacher practice. Many such conceptions are linked to pedagogical expertise (Fullan & Langworthy, 2014; Shulman & Shulman, 2004) with other models placing value on a combination of knowledge, relationships, and elements of the affective domain (emotional intelligence, inter- and intrapersonal knowledge) (Billett, 2009a; Collinson, 1999). Still others propose the need for conceptualising an expertise that traverses workplaces and systems through relational expertise (A. Edwards, 2011).

The twenty-first century context with high degrees of change, a need for new pedagogical focus responding to customised learning in ICT-rich, collaborative environments, and the novel context of open plan settings places further importance on establishing a contemporary picture of teacher expertise. Teachers must respond to the changed circumstances of space, curriculum structures, school-level responses to the national curriculum and the general move toward personalised learning. The impact on teachers of the recognised and deliberate ambiguities and disruptions of built space and innovation programs is relatively unmapped in the related literature. Research conducted in BEP schools or similar settings has revealed the need for teacher adaptation through flexibility, increased collaboration, and engaging with openness (Alterator & Deed, 2013; Deed, 2015a; Deed & Lesko, 2015; Lovejoy et al., 2014; Whitby, 2013).

Framing open plan practice and teacher expertise: Adaptive expertise

Teacher adaptation is underpinned at a theoretical level by readings of adaptive intelligence (Sternberg, 1984, 1985). Expressed as adaptive expertise, this concept is understood as the adjustment of practice beyond that which has been routinised (Salomon & Perkins, 1989; Sternberg, 1984). In this way, novel settings, problem solving, and disruptions become instances where adaptive expertise is required. Adaptive expertise has been read as occurring when efficiency is high (expressed as

routine expert as distinct from novice), thus freeing time and mental space for innovation and problem solving (Schwartz et al., 2005; Sternberg, 1985). Mercier and Higgins (2013) understand adaptive expertise to be a balance between innovation and efficiency in problem solving.

The model of expertise taken as providing the requisite foundation for teacher practices occurring in open plan, collaboration-intense settings is the prototype model (Sternberg & Horvath, 1995). This model is based on a triarchic understanding of human abilities taking in knowledge, efficiency and insight. The model is reflected in recent models attempting an account of procedural and affective components of teacher expertise (Billett, 2009a; Collinson, 1999). However, adaptive expertise provides a model that accounts for teacher knowledge and development in novel settings demanding changes to existing practice.

The interplay between efficiency and innovation, in particular, provides insight to the identification of emergent skill sets in the open plan settings. Sternberg and Horvath (1995) proposes that experts are more efficient at solving problems when routines of practice are embedded. Likewise, Schwartz, Bransford and Sears (2005) identify adaptive experts as being highly proficient in routine and innovation. This is problematic in that the settings under examination in this study are intentionally ambiguous and purposively disruptive. The settings themselves are attempts to move teachers away from the established routines.

Schwartz et al. (2005, p. 30) acknowledge that "innovation often requires a movement *away from* [original emphasis] what is momentarily most efficient for the individual or the organisation". The adaptive expert is recognised as having the sort of efficiency that means knowledge is available to remain adaptable when faced with challenges (Schwartz et al., 2005; Sternberg & Horvath, 1995). The accumulated knowledge and efficiency of routine frees up *attentional bandwidth* for non-routine moments (Schwartz et al., 2005).

This study recognises teacher expertise as a mix of routines and innovation expressed as adaptive expertise. The open plan settings place a premium on navigating the opportunities of the new settings with the requirements and habits of ongoing school routines that constitute practical knowledge.

Mapping of open plan learning spaces was undertaken by Deed (2015a) in his study of a single school site in the BEP project. The summarising of teacher practical knowledge maps teacher understanding of current practice and possible practice against particular spaces (large scale open plan/enclosed spaces/science and art labs/breakout zones). Deed's study provides a lead on insights gained from a BEP setting specific to the salient moments of practice for identifying teacher skills.

Table 1

A map of teacher practical knowledge

Learning environment	What currently works	What might work
Neighbourhood • Flexible teaching and learning practices • Varied furniture types and layouts	Explicit teaching Flexibility to allow students to choose space for work Social learning Use of technology	Sharing resources and ideas between colleagues Social learning Effective use of technology Productive learning Self-directed learning
Socratic • Enclosed teaching space • Audio-visual resources	Explicit teaching Use of media Class discussion	Use of interactive technology Increased student autonomy
Da Vinci • Arts and Science learning • Project space	Explicit teaching Experiments Project-based learning Social learning	Exploring learning through experimentation Multi-disciplinary project work Independent learning – (structured and scaffolded)
Einstein • Breakout space • Main entry/exit to learning community	Independent and small-group work Break-out area Informal interaction	

Note: (Deed, 2015a, p. 33)

This study extends the work of Deed (Deed, 2015a) to examine multiple school sites with a specific focus on observed practices and teacher perception of skills emerging from the existing practice and potential practices identified as innovative or adaptive practice relying on adaptive expertise.

Summary: Theoretical orientation

The unique nature of the up-scaled open plan learning settings is reflected in the broad scope of literature informing the elements impacting the understanding of teacher practice. The literature provides leads and suggestions for theoretical orientation and data collection. Converging on attempts by teachers to achieve customised learning experiences understood as emerging from and befitting the twenty-first century context, this study understands the increased importance of teacher and student agency. In particular, as each engage with the charged and recondite settings teacher practice is impacted through an ongoing navigation of existing practices and traditions as well as prompts designed to disrupt and encourage innovation.

Further, the highly collaborative environments require teachers to work in teams of varying sizes and shifting degrees of influence. The impact of initiatives such as joint teaching stretching the work of teams across learning communities and/or subject disciplines further exaggerates the impact of collaboration and suggests a sophisticated understanding of agency in such settings is required. A heightened focus on relationships with empowered learners based in small communities further emphasises the importance of teacher teams. The work of Giddens (1984) and more recently Edwards and D'Arcy (A. Edwards & D'Arcy, 2004) and Edwards (A. Edwards, 2011) provide a foundation and advance on the comprehension of agency. Structuration and relational agency offer a theoretical orientation capable of catering for the nuanced interactions occurring in the open plan settings.

The changed physical settings of open plan schools are a clear departure from established school traditions. The up-scaled environments offer a range of potential

responses. As teachers negotiate the ongoing work of running a school they must balance necessity with innovation; traditions with variations. Affordances (Gibson, 1977) provide an orienting theory assisting the reading of the school spaces as the physical and social elements interact and impact teacher practices.

The theoretical orientation is further influenced by the revelations in the literature for the need of close examination of the lived experience. Where architectural assumptions lead to reductive interpretations of open plan settings, and existing research is focused on quantifiable but inherently limited factors such as natural light and temperature, a close examination is required to establish insights on the emerging teacher practices.

The understanding that teacher knowledge is characterised as practical or a combination of theory and practice expressed in action suggests a reasonable focus on the phenomenon. A phenomenological approach, ground in a constructionist foundation, is buttressed by an orientation taking in pragmatism. Together, the ontological and epistemological orientation of the study allows for a robust exploration of the settings focused on the lived experience.

The following chapter presents a detailed account of the multi-theoretical orientation informing this study. It locates the study within the chosen frames and commences the work of synthesising the lenses in order to establish the methodological approach and subsequently draw meaning from the data.

Chapter 3 Theoretical framework

This study is an exploration of the impact on teachers of generating customised, twenty-first century learning experiences in open plan learning environments. The research sought to identify the emergent teacher practices stemming from the ongoing occupation of the spaces and in the adaptation by teachers and schools through their responses to the possibilities and limitations of the new settings.

A multi-theoretical orientation

This chapter presents the theoretical orientation of this study. This is achieved through a multi-theoretical approach drawing on meta-level theories of constructionism (Berger & Luckman, 1966; Dewey, 1963), pragmatism (Dewey, 1997/1938) and phenomenology (Chamberlin, 1969; Gergen, 1999). Further orientation is taken from Giddens' (1984) structuration theory and affordance theory (Gibson, 1977). Micro-level theory is taken from relational agency to narrow the focus of the study (A. Edwards, 2005). Criticisms of each are considered and an argument is developed for their inclusion in orienting this study. A case for focusing research of teacher knowledge on the phenomenon of practice within up-scaled open plan settings is outlined. Finally, an illustrative example is provided demonstrating data analysis using the multi-theoretical orientation.

This chapter establishes a convergence of theory around quality teaching and learning experiences. The twenty-first century presents a multifaceted, dynamic and changing environment with an educational inheritance taking in progressive thinking to challenge established industrial patterns (Darling-Hammond, 2014; Kuhn, 2011; OECD, 2012). These challenges can be seen in the disruptive prompts of open plan school settings (McGregor, 2004a, 2004c) and the provocations and invites inherent in technology-rich environments. Quality in this area seeks to customise learning in regards to pedagogy and physical environment (Boys, 2009; Dewey, 1997/1938; Prain et al., 2013).

The study of up-scaled open plan settings of the BEP allows for an examination of attempts to achieve customised learning as part of deliberately disruptive buildings and innovative curriculum structures. In particular, the research sites admit the examination of teacher response (practice and beliefs) to altered conditions in the heightened settings of highly collaborative, agent-enhancing, school-less spaces (Alterator & Deed, 2013; Deed & Lesko, 2015; McGregor, 2003b).

The purpose of this chapter is to position the research of teacher practice within these dynamic and complex settings against the relevant theory. This study is oriented by a multiple theoretical position drawing on established theoretical frames and data-specific analytical orientation in order that data can be made sensible (Silverman & Marvasti, 2008). The research can be characterised as an ethnomethodology with a focus on everyday practice attempting to understand the emergent practices of teachers in open plan settings.

The ongoing reflexive process as part of constructivist grounded theory research demands an orientation that is informed by both initial theoretical positions (justified as valid to the study) and subsequent response to data collection (made robust by being ground in the observable world) (A. Bryant & Charmaz, 2010; Charmaz, 2006).

The importance of agency in theoretical understandings

This study recognises the re-emergence of agency as a critical factor in non-standard, non-algorithmic practice requiring sophisticated teacher intervention relying on frequent and charged interactions (A. Edwards, 2005; A. Edwards & D'Arcy, 2004; D. Edwards et al., 2014). The concept of agency has also influenced contemporary developments in learning theory and architectural ideas with each generally attempting to leverage greater agency in teachers and students (for architecture see for example: Boddington & Boys, 2011; Boys, 2011b; Dudek, 2000; R. Fielding & Nair, 2005; Nair et al., 2009; Nicholson, 2005) (for educational theory see for example: R. Barnett, 2007;

Bonk & Cunningham, 1998; Dewey, 1997/1938; Fullan & Langworthy, 2014; Sagan, 2011; Savin-Baden et al., 2008).

Affordance theory offers a further conceptualisation that serves both architecture and education. The theory dovetails with the idea of agency through the core insight that agents take up or engage with the possibilities provided by the environment (Gibson, 1977). Gibson's initial neutral rendering of the surroundings may remain stable within a strict ecological reading; however, the adoption of the term to understand and enhance deliberate features of architecture and design, as well as in reading social activities, means that the relationship between agent and environment is seen as critical. The role of agent assumes a new potency.

The influence of this insight is seen in the literature on agency (cited above) and is seen in architecture and design through the work of Norman (1988), Maier, Fadel and Battisto (2009), and Xenakis and Arnello (2013). The treatment of affordances with a specific concern for socio-spatial practices of the occupying agent is seen in literature interested in an empirical approach (Boys, 2009; Melhuish, 2011), as well as conceptually oriented (Caiani, 2014; Greeno, 1994; Letiche & Lissack, 2009; Turvey, 1992).

Compatibility of agent affirming theories orienting this study

This chapter argues for the complementary nature of the theories orienting the study. It argues for the compatibility of the ontological assumptions in constructionism (Berger & Luckman, 1966; Dewey, 1963; Gergen, 2001) and the agent affirming theories of structuration (Giddens, 1976) and affordances (Gibson, 1977). Relational agency (A. Edwards & D'Arcy, 2004) extends the work of agent-oriented theories and focuses the methodology of the study.

Particular tools – both theoretical and practical – developed as part of recent studies of open plan settings are employed to guide the research of enacted instances of practice that constitute teacher responses to the novel settings (Deed, 2015a; Prain

et al., 2013; Prain et al., 2014c). These tools have emerged from similar theoretical backgrounds as those offered as justification and orientation of this study.

The epistemology of this study is prompted by the particular ontological orientation. Pragmatism and phenomenology are consistent with constructionism. Pragmatism reveals knowledge to be created in the practical (Dewey, 1963) while the phenomenological focus on 'the things themselves' (Chamberlin, 1969) justifies and informs the narrowing of data collection toward contextualised moments.

Further analytical orientation is informed by literature considered to orient the study (twenty-first century pedagogy, assumptions of open plan education design, and understanding of space) or emerging as relevant to the data as it was collected (teacher knowledge and expertise, team teaching, adaptability, visibility/freedom and collaboration).

Constructionist ontology and macro and micro organisation

This study acknowledges the binary division of micro and macro structures present in much theory construction (Lock & Strong, 2010). A description of the various theories will be provided that locates them within this organising scheme. However, the theoretical structures of this study have forged an outlook actively working toward eliminating divisions found in 'big theory' sociological traditions that sought to establish fixed or deterministic social theories akin to natural sciences (Weinberg, 2014).

The elimination of binary divisions informing the ontology and epistemology of pragmatism and phenomenology (Bacon, 2012; Lock & Strong, 2010) inform and run concurrent with the development of constructionism. Tracing back to Husserl and Heidegger, and extended by Merleau-Ponty, Sartre, de Beauvoir, Murdoch, Foucault, and Camus, the broad inheritance within philosophy is acknowledged (Lock & Strong, 2010).

Without conceding ontological or epistemological ground, the theory of constructionism can be characterised as a macro structure theory informing this study.

The seminal work of Berger and Luckman – *The social construction of reality* (1966) – reveals the fundamental nature of the constructionist world to be culturally relative. The ontological assumptions of constructionism imply an interdependence of societal structures or culture and individual participation.

The broad epistemological position of this constructed world is such that individual, subjective accounts are legitimised as containing truth-value. Within the sensuous realm of Marx's purview constructionists find 'Truth' shifting to 'truth' which "achieves its validity within a local form of life" (Gergen, 1999, p. 38). Moreover, the observer (sociologist) is understood to make no claims on absolute truth; rather the observer is "enjoined to understand the target in terms of his or her immersion in the tradition" (Gergen, 1999, p. 38).

Further macro structure theories orienting this study include structuration theory and affordance theory. A closer account of complementary epistemological understandings is provided in pragmatism and phenomenology. Each of these falls within the macro structure category.

Structuration theory

Giddens' structuration theory (1984) is an articulation of how a micro/macro interdependence unfolds for individual agents. In each case, the duality is dissolved to leave the agent with a genuine choice that serves to break down or confirm the extant cultural structures through a recursive engagement achieving social reproduction.

Giddens (1984) asserted that reflexivity is paramount to the recursive nature of social activities; indeed, recursivity "presumes reflexivity" (p. 3) and reflexivity is only possible because of the continuity of practices. "'Reflexivity' hence should be understood not merely as 'self-consciousness' but as the monitored character of the ongoing flow of social life" (p. 2).

> The reflexive monitoring of action depends upon rationalisation, understood here as a process rather than a state and as inherently involved in the competence of the agents. (Giddens, 1984, p. 3)

The stratification model of the agent (Giddens, 1984, p. 5) represents the reflexive interplay between individuals and the structures they encounter and affirm through their action. This model of agency is recognised as a key theoretical frame for this study.

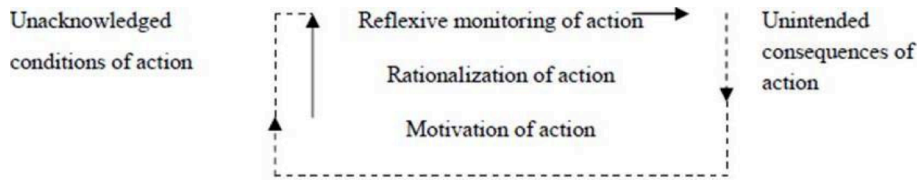


Figure 2. The stratification model of the agent. "The constitution of society" A. Giddens, 1984, California, University of California Press, p. 5.

Giddens' structuration theory has not completely abandoned large societal structures, though his articulation sees them as recursive expressions of social practices across space and time. This theory is described as attempting to explain how the "micro-activities of everyday life line with the macro-exigencies of social existence" (Lock & Strong, 2010, p. 214).

To achieve this, structuration theory takes on fundamental assumptions shared with constructionism: a focus on situated activities, and gathering meaning from situated agents (Giddens, 1984). Importantly, the existence of cultural constructs through reproduction by purposive agents allows for both the constructs and the social construction of reality of constructionism.

Giddens (1976) understood human agency as being bounded. It is both enabling and constraining. Humans are producers of society but they are also "historically located actors" (p. 160) bound by conditions beyond their control. At the same time, structures are not simply constraints on agency, they are also enablers, "agency presumes constraints – but what is harder to understand is that constraint presumes agency" (Giddens & Pierson, 1998, p. 85).

Structuration theory and the understanding of teachers as purposive agents

The impact on this study is two-fold. The macro-theory orientation means that the practices of teachers are understood as purposive agents engaged in choice-making. Agency assumes an importance that elevates the role of individual to institution maker, or at least to structure maker. The actions of teachers in the open plan spaces can be read as that which establishes the patterns or systems within the community. This reveals the thinking of teachers as they negotiate ongoing traditions and respond to the altered setting. The altered school sites provide a range of enablers and constraints specific to the open plan format with an inheritance from the traditions of teaching and specific subject disciplines. Secondly, the structuration grounding of truth within a situated reality aligns with the use of phenomenological epistemology and qualitative case study outlined in the methodology chapter.

Affordance theory

Gibson's (1977) affordance theory offers another macro structure theory orienting this study. Affordance theory asserts that the physical environment provides or offers animals certain possibilities. Originating in ecological psychology (Shaw & Bransford, 1977) affordance theory is extended by Turvey (1992), and Greeno (1994), each elevating the role of agent. Through prospective control (Turvey, 1992) and interactive properties (Greeno, 1994), reciprocity between agent and affordances is understood as critical to an affordance being actualised (Letiche & Lissack, 2009).

Turvey provided the ontological features of affordances:

> An affordance is a real possibility
> An affordance is a disposition (in the most general of cases, it will comprise a configuration of substantive properties.)
> An affordance is complemented. (Turvey, 1992, p. 179)

Following this reading, an affordance is both a real possibility, or an as yet actualised possibility, and the "causal propensity for an animal to effect or bring about a particular action" (Turvey, 1992, p. 179).

Greeno (1994) further developed the understanding of affordances by clarifying the relationship between agent and affordance:

> …the affordance is a property of whatever the person interacts with, but to be in the category of properties we call affordances, it has to be a property that interacts with the property of an agent in such a way that an activity can be supported. (Greeno, 1994, p. 340)

The similarities to Turvey's (1992, p. 179) complementation are evident: "whereas an affordance is a disposition of a particular surface layout, an effectivity is the complementing disposition of a particular animal". According to the reading of affordances by Turvey and Greeno, reciprocity between agent and affordance is essential to the affordance being actualised.

A further extension of this work is made in understanding affordances as a combined product of the animal-environment system (Chemero, 2003). That is, they are not simply properties of the environment, nor is it enough for them to be complemented; rather, they are the emergent properties of the animal-environment system (Stoffregen, 2003, 2004).

Affordance theory and teacher responses within open plan settings

This study forwards the following conceptual framework of affordances in understanding teacher responses to open plan learning environments. After Gibson (1966), it is set of environmental conditions that furnish action. After Turvey (1992) and Greeno (1994) it is refined to a reciprocal arrangement between agent and environment. Extended by Chemero (2003) affordances are relations. The relation holds between environment and organism. Further, it is understood as an emergent property of the animal-environment system (Stoffregen, 2003).

Affordances have received considerable attention in architecture and design (Norman, 1988). As these traditions embrace possibilities beyond the deterministic designer, a subtle understanding emerges with a clear focus on the agent. Affordances present in designed structures indicate what is possible, regardless of whether they are realised (Maier et al., 2009). This is acknowledged in social science research with the use of terminology such as 'action possibilities'. The ongoing practices of teachers in the open plan settings is a measure of what practices carry over and what possibilities are taken up (Deed & Lesko, 2015; Lovejoy et al., 2014).

Gibson commits to a similar ontological turn as Giddens. The synchronous elevation of the agent in both theories remains consistent with constructionist principles. This is particularly the case where affordance theory has moved beyond the borders of ecological/environmental psychology (Letiche & Lissack, 2009; Maier et al., 2009). Gibson (1966) is explicit in folding the cultural and the natural environments into one, asserting that culture emerged from natural opportunities.

Relational agency

Consistent with Giddens' theory of agency, relational agency (A. Edwards, 2005) contends that dynamic and changing social settings prompts agents find moments of stability through connections in practice and subsequently establish common knowledge (A. Edwards, 2011). Relational agency identifies interactions within practice

as revelatory moments. This suggests that the practice of teachers as they relate to one another and interact with students is critical to understanding agency in school settings.

Relational agency emerges from the need to find stability within dislocated, mobile, and increasingly virtual communities (A. Edwards, 2005). Such a description of agency provides the opportunity to extend on the work of Giddens by considering agency in action. It allows for agency to assume a context. Without demanding a conceptual shift in the understanding of agency it provides an extension of the parameters within which it can be reasonably examined. It does this by acknowledging the joint work of agents as part of the necessary constraints and enablers associated with being an actor in the world. Relational agency can be said to account for the experience of teaching in the twenty-first century.

Relational agency in open plan schools

A close examination of teaching in open plan schools adopting learning communities confirms the resemblance to Edwards' description (A. Edwards, 2005). The schools are dynamic settings presenting a range of complexities that teachers must navigate in their daily work. Achieving the customised learning experiences described above demands that teachers negotiate across communities within the school, teams within their home community, and, at times, communities beyond the school itself.

Relational agency and teacher knowledge

Edwards' understanding of mediation and the outline of teacher knowledge as assuming a practical expression are conceptually aligned. Edwards (A. Edwards, 2005) asserted that the role of Vygotsky's mediation was important in framing (and conceptualising) relational agency. Vygotsky's stimuli-means are central to mediation: cultural artefacts available to individual actors as they navigate through their world (A. Edwards, 2005, p. 170). Further, Edwards argued the subsequent shift in understanding of consciousness from an explanation of behaviour to a feature of activity meant an examination of mediational means as resources was plausible. As a result, mediational means can be seen as "resources which turbo-charge performance and people learn to use them with the help of others" (A. Edwards, 2005, p. 171). The collaborative work of

teachers in novel settings is understood as those interactions and moments whereby practice is turbo-charged or enhanced. The particular meditational means are expressed through interactions focused on practice.

Edwards (A. Edwards, 2005) provided a conceptual outline of how these interactions work. She acknowledged that relational agency is connected with distributed intelligence. This is the understanding of intelligence as something that exists outside the mind. It recognises that "cultural tools, both material and representational, are loaded with intelligence, which enhances action" (p. 172). Distributed expertise is described as a sub-category of distributed intelligence and relates more to practice. The author explained that it is more likely to be found across a "cluster of distinct local services" (p. 173) with a single focus. It can also be seen in system-wide approaches to problems.

> The argument, in summary, is that we transform the world through first interpreting and then acting on the basis of our interpretations. Interpreting and responding involve the conceptual and material resources we have at our disposal. (A. Edwards, 2005, p. 173)

Agency: activity systems in socio-cultural theory and activity theory

Edwards (A. Edwards, 2005) acknowledged the synthesis of socio-cultural theory and activity theory in conceptualising relational agency. Engestrom, Miettinen and Punamaki (1999) offered activity theory in response to the need for analysis of society that featured increasingly complex interactions and relationships: "object-oriented, collective, and culturally mediated human activity system" (p. 9). Engestrom et al. (1999) offered a broad view of construction of society: one that is focused on knowledge, artefacts and institutions, all of which are modifiable. They asserted that individuals are able to construct institutions and activities "above all by means of material and discursive, object-oriented actions" (p. 10).

Engestrom's (1999) mediation provides a focus on activity establishing insights for observation. Activity theory does not need to replace the ontology established by Giddens and does not contradict it. It is consistent with Giddens while allowing the manoeuvre that brings focus to object-oriented actions. According to Giddens (1984) the interplay between agents and structures can be seen to be recursive, interdependent and mutually reliant. Giddens (1984, p. 36) contends that each "enters into the constitution of the other, as they both do into the constitution of the acting self". Further, the duality of structure is seen in social systems. Giddens states that systems "both express and are expressed in the routines of daily social life, mediating the physical and sensory properties of the human body" (p. 36).

Davydov (1999) articulates activity theory and further confirmation of the conceptual dovetail between activity theory and structuration can be seen:

> Activity is a specific form of the societal existence of humans consisting of purposeful changing of natural and societal reality. In contrast to the laws of nature, societal laws manifest themselves only through human activity that constructs new forms and features of reality. (Davydov, 1999, p. 39)

According to Edwards (A. Edwards, 2005), relational agency "shifts the focus from the system to joint action" (p. 174). She asserted that through joint action it is more likely that the object will be expanded and, importantly, "learning experienced and conceptual tools in turn refined" (p. 174). While the interactions are often fleeting, they are also object-oriented with particular attention to "individual change as a result of joint action rather than transformation of the system" (p. 174). Activity systems are acknowledged as present within the complex settings involving fluid and emergent practice. The theoretical influence in establishing a focus on joint action and object-oriented practice is clear. Maintaining a theoretical focus on the agent and reflexivity allows for an examination of the micro level development of skills and knowledge specific to the open plan settings.

Reading teacher practice as agent choice

Reading teacher practice therefore becomes a reading of agent choice within particular but complementary frames. Beginning with socially constructed reality of constructivism, structuration elevates the agent to system creator through reflexivity and affordances position the agent as choosing certain behaviours in response to environmental conditions. Combined, the now central and pivotal agent realises the structures and actualises the affordances through a complex negotiation of enablers and constraints.

Open plan and shared office space produce high levels of visibility and accountability (Lovejoy et al., 2014). Shared teaching spaces take negotiations into teaching time that often demand sensitive decision making within pressured situations (Alterator & Deed, 2013). Though the learning communities are a response to the strain on the teachers and students as a result of dislocated communities of late capitalism, the experience of the teacher may exacerbate the dislocation (A. Edwards, 2005; Thompson, 1989). It is clear that teachers in the novel, open plan context would be compelled to find Edwards' moments of stability.

Relational agency (A. Edwards, 2011) provides prompts as to the type of practices needing attention to develop a rich picture in the dynamic school settings: the action of teachers as they establish common knowledge through shared practice. Edwards articulates the actions as micro-negotiations: object-oriented, joint focused, often fleeting with the focus on individual change as distinct from system reform (A. Edwards, 2005). This articulation provides theoretical justification for the study's focus on teacher practical knowledge.

Agency: Epistemology, criticisms, and an advance

Pragmatism and Phenomenology: Understanding agency

Pragmatism and phenomenology act in unison to focus the study on reading of teacher practice and preferencing the practical knowledge of teachers. Given the criticality of agent action, the pragmatist focus on knowledge as practical (Dewey, 1963;

Misak, 2007) is seen as congruent with this study. Dewey's understanding of knowledge as 'exploratory process' (Quinton, 2010) affirms the seeking of emergent knowledge in a changed setting.

Dewey's pragmatism shares similar insights to Edwards' relational agency further legitimising the use of pragmatism in this study. Each see knowledge as socially created and the centrality of action is focused on objects or artefacts; to wit, Dewey's objects are understood as objectives of inquiry (1938) while Edwards sees object–oriented cultural mediation at the heart of establishing distributed intelligence (A. Edwards, 2005). Similar insights are found in activity theory (Engestrom, 1999; Engestrom et al., 1999) and the work of Vygotszky (1998).

Dewey's knower is distinct from the Cartesian *res cogitans*. The discrete, separate mind is abandoned in favour of an embodied, intelligent being with knowledge being socially created (Quinton, 2010). A focus on knowledge as constructed by humans is clearly warranted and justified by a constructionist frame.

Merleau-Ponty (2012) established a philosophical rationale informing Flyvbjerg's (2001, 2006) elevation of experience: he considered the Cartesian cogito and concluded "It is me who assigns my thought the goal of taking up the movement of the *cogito*". Further, "I could literally think nothing of it if I did not have, in myself, all that was needed to invent it" (Merleau-Ponty, 2012, p. 389).

Phenomenology (Merleau-Ponty, 2012) is congruent with pragmatism with the focus on the phenomenon of a thing as the key source of knowledge (Lawlor, 2014). The embodied knower necessarily occupies a setting and the artefacts at the heart of Edwards' micro-negotiations to establish common knowledge (A. Edwards, 2011) can be identified through a phenomenological epistemology. Taken together, pragmatism and phenomenology justify the focus of knowledge creation on the fine-grain, micro embodied practice of teachers. This is taken as a key prompt for orienting the direction of data collection.

The use of structuration and affordance theory builds on this foundation by focusing the attention on the actions of individuals or groups of individuals as they conduct the practice of teaching. The normalisation of practice through establishing and maintaining structures in response to physical settings provides key insights for understanding salient practices and focusing data collection strategies. The elevated agent and the importance of the situated experience are harmonious with pragmatism and phenomenological insights.

Criticisms of structuration theory

Structuration theory can be criticised for being unconcerned with empirical research. Gregson (1989) accuses Giddens of providing a second-order theory whereby the theory remains occupied with explaining generalities of human society. Giddens can be characterised as remaining committed to ontological revelations and not interested in the work of social science; namely, to theorise the unique and illuminate processes of the lived experience.

Giddens' (1991) later retort that his theory is not 'of anything' but rather a conceptual scheme is enough to proceed with here. Structuration provides a sound ontological foundation and is linked with a range of empirically based studies (C. Bryant & Jary, 2001a, 2001b; Giddens, 1989, 1991; Giddens & Pierson, 1998). This study uses structuration to orient the elements of agency and to understand the elevated position of individual teachers as they respond to and shape the unique settings of open plan schools.

Structuration has been criticised for its account of agency as inherently enabling; that an agent is never out of options. The counter to this is the instance where an agent is reduced to one option. Where choice is reduced to a single course of action it is argued that agency is void (Thompson, 1989). This attacks the heart of agency suggesting the central premise is wrong: that an individual is never not an agent.

Essentially, Thompson is denying the Giddensian move that combines structure and agency. Thompson asserts that the two remain locked in a duality as in two poles standing in tension with one another (Thompson, 1989). The re-rendering of the relationship amounts to a false premise within the framework outlined by Giddens. At the heart of the response is the idea that structural constraint "derives from the institutionalised nature of social practices in a given context of action" (Giddens, 1989, p. 258). The recursive loop frees structuration from the criticisms of Thompson. At a practical level this study acknowledges the constraining factors present in school settings while remaining true to the central ontological assumptions of structuration.

Nested agency: Locating agency in schools

A sophisticated advance for understanding the types of agency present in school settings is provided by Prain et al. (2013). The authors conceptualise the location of agency within schools as expanding spheres. Figure 3 demonstrates the various elements of structure impacting on agents. This construct acknowledges the structures that exist as part of the broader educational institution as well as local factors such as timetable and space: nested agency. It also makes clear the social systems and the objects or artefacts around which these revolve; namely, relational agency. The construct of expanding spheres locates the interactions between teachers and the items upon which their interactions centre.

> The construct of "nested agency" recognises that the agency… is constrained by structural, cultural and pedagogical assumptions, regulations, and practices, including prescriptive curricula, and actual and potential roles and responsibilities of teachers and students in school settings. (Prain et al., 2012, p.8)

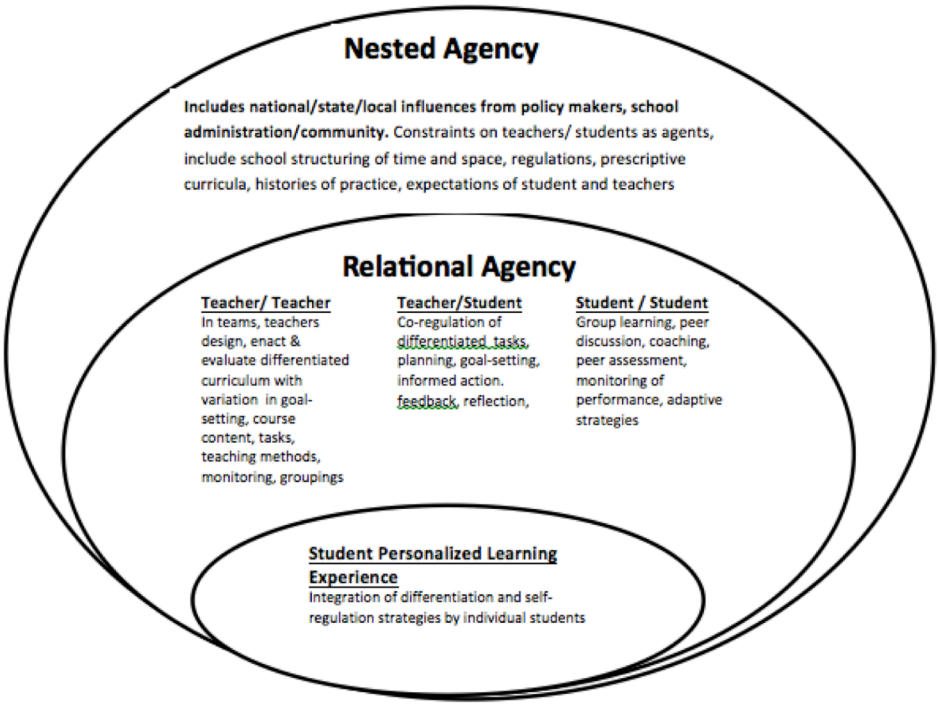


Figure 3 Framework for conceptualising and enacting personalised learning "Personalised learning: Lessons to be learnt". By V. Prain et al. 2013, *British Educational Research Journal, 39*(4). p. 259.

Prain et al. acknowledge that agency is constrained by a range of factors, these include "prescriptive curricula, particular assessment regimes, the organisation of the curriculum, perceived and actual teacher and student roles and responsibilities in and beyond the school setting, and broader social and cultural expectations about norms for teaching and learning processes" (2013, p. 9).

The model by Prain et al. (2013) locating the occurrence of agency acts as a prompt toward the identification of meso and micro-system layers within this research. Where the macro theoretical orientation is provided by structuration and affordances, the particular units of analysis are found in the instances of relational agency. Therefore, the meso-system is identified as the nested agency elements that impact on agent choice and, to varying degrees, impact on the negotiation of teacher choice as

they navigate the relevant interactions. The micro-system is made up of the particular interactions (teacher-teacher, teacher-student) seeking to improve the learning outcomes of students.

Further orientation informing the units of analysis is taken from work conducted within the BEP school settings. The identification of the increased interactions (Alterator & Deed, 2013) and mapping of teacher practical knowledge (Deed, 2015a) has focused the salient moments to negotiations between teachers as they adapt their practice to the new settings.

Relational Agency in schools

An account of agency in open plan school settings

Drawing on the foundations provided by structuration and affordance theory, an account of the occurrence of relational agency within schools is provided. These are the micro-negotiations taking place as part of collaborative practice. According to A. Edwards and D'Arcy (2004, pp. 149-150) relational agency is more than simple collaboration; it is the capacity to identify and engage the support of others as "resources for action and equally to be able to respond to the need or support from others".

Following the understanding of teacher knowledge as practical or situated (Elbaz, 1981; Verloop et al., 2001), the particular moments of engaging to enhance practice and support are identified through the mapping of teacher practical knowledge occurring in BEP open plan schools by Deed (Deed, 2015a) and the earlier investigations of teacher responses to the open plan settings by Alterator and Deed (2013).

The ongoing practice in schools can be interpreted as activity systems (Engestrom, 1999) identified by routines or conventions (Giddens, 1984) as teachers engage in daily practice. These are conceptualised as occurring as part of an ongoing reflexivity.

The novel settings of open plan schools with deliberately disrupting physical spaces and the impetus to alter curriculum structures to accommodate for twenty-first century conditions demand responses and adaptations to existing practice by teachers. This places an emphasis on innovation by exploring new territory specific to shifting spheres of collaboration, enhancing student agency and developing practices to suit.

The context of open plan schools establishes sets of enablers and constraints contrasting with traditionally arranged schools. Affordances of schools are characterised as primary and secondary and constituting the physical and social realms (Prain et al., 2014a). This aligns with the insight that agency occurs within a particular context taking in nested and relational agency (Prain et al., 2013).

The various affordances of traditionally arranged schools are seen to impact the agency of actors occupying the setting (Gibson, 1977; Giddens & Pierson, 1998). Schools arranged by traditional means can be uncontroversially generalised as possessing certain features. They occupy similar spaces with general teaching rooms accommodating one class accessed via a central corridor. Arranged traditionally, schools use a single timetable demanding conformity from all subjects and teachers. These features dominate pedagogy and workforce planning alike. Single classes dominate and staff interaction is limited to the staffroom or office. This is often arranged by discipline area. The constraining effects of conventions in such a setting are easy to observe. They are overt and dictated by the physical constraints. Inasmuch as social structures exist in these spaces, it is reasonable to understand them as being heavily constrained by the physical features. Indeed, such is the force of these features in traditional school settings that exceptions to the above description are rare.

Open plan schools are also endowed with a set of affordances working as constraints and enablers. While the spaces themselves have achieved success in removing the obvious physical constraints of the traditional model, the necessity of structural features such as timetables, staffing and subject offerings are still present. Consistent with Giddens' understanding of agency and properties, the open plan schools should allow for conventions to emerge and develop free of the overt physical

constraints in the traditional model. In this way the spaces themselves can be seen as enablers or as productive constraints.

The open plan spaces increase teacher interaction. Such interactions focus attention on the reflexive monitoring of action by agents. The sample analysis below provides an attempt at exploring the response to the central question of this study while following the generative insights taken from the literature review.

Units of analysis

Drawing on the multi-theoretical frames outlined above the units of analysis are made up of the teacher perceptions and observed instances of practice. These are understood as occurrences of relational agency as teachers adapt to new settings with various affordances constituting enablers and constraints. Teacher knowledge is taken to be practical and innovation and development takes place in the complex and uncertain intersection of agency and affordances.

Illustrative example

An illustrative example is provided from Case Study 1. The compelling insights provided by the macro theoretical structures and the constructs for interpreting these have been applied to demonstrate their usage. The unit of analysis is made up of teachers self-reporting on the changed practice and understandings of possibilities. The epistemological frames suggested examining the fine grained realisation of teacher agency. This instance represents the exploratory phase of research informing further research through interviews and observations.

The agent and the environmental factors exist in a feedback loop

It is critical to understand that the environmental factors and agent action exist in a feedback loop (Gibson, 1977) that continually recasts the affordances in line with adaptations and social practices made by the agent. The resulting practices are confirmed or challenged by the agent engagement in reflexive monitoring (Giddens, 1984). This intersection is abstracted as a threshold of change (Prain et al., 2014a).

Illustrative example: setting

Alluvial Secondary College adopted joint English classes as part of the specific response to the affordances of the open plan setting. The arrangement constituted three teachers and 70 students scheduled into a single large space. This was a case of nested agency: the decision was taken by the school as a professional community but constituted a formal curriculum strategy. The decision was based on the understanding that the English discipline had an established grounding in constructivist pedagogy and the repertoire of teaching activities could be up-scaled in such a context.

Illustrative example: reading agency and affordances

The physical environment afforded the arrangement of classes substantially different to the traditional experience. The decision to arrange team teaching of the joint classes was a case of nested and relational agency. The strategy was part of the curriculum approach but the particular response of teams was not dictated. The English department understood team teaching offered a concrete instance of practice within the new settings. The existing structure within the department also offered opportunities for collaboration in planning and strategizing generally.

The implementation of the team teaching actualises a new set of affordances to the teachers. This new set of affordances subsequently presented action possibilities not perceived prior to the initial affordance. Hence, the feedback loop is completed and ongoing social practices form out of existing teacher practice and new demands. The micro theoretical insights are referenced in the chart below.

Table 2

Illustrative example: visual representation of reading agency and affordances

Affordance	Action possibility	Agency type
Open space learning environment	3 classes combined: Humanities + English	Nested
	Team teaching	Nested & Relational
Teams/teaming (Fullan, 1993b; Rogers, 2002)	Collaborative practice Team orientation (Hatton, 1985) Team protocols Prototype lesson Joint planning Flattened hierarchy (Alterator & Deed, 2013)	Relational

A detailed rendering of the data using the above method allows for the identification of the skills required for successfully engaging with the teaching and learning occurring in the open plan learning spaces.

The illustrated example serves to demonstrate the orienting role of theory adopted in this study. The fine grain examination prompted by pragmatism and phenomenology requires a detailed extrapolation. Interview transcripts and observations revealed a complex interplay between the physical environment, perceived affordances, and teacher practice. This is provided in the Methodolgy (Chapter 4) within the context of data collection strategies and analysis logic.

Chapter 4 Methodology

The following chapter provides the outline and justification for the design of this study. Transparency is achieved in the outline of the epistemological and ontological assumptions. The role and perspective of the researcher is outlined and adds to the transparency. Further, the research approach and methodologies emerging from the theoretical base are outlined as well as the data collection and analysis methods. The study's limitations and efforts to achieve fidelity to the principles of validity and reliability are discussed thereafter.

Epistemological orientation

Phenomenology

Phenomenology and pragmatism are the epistemologies informing the methodology adopted in this study. Phenomenology is predicated on Husserl's seminal insight of concern with 'the things themselves' (Chamberlin, 1969; Lawlor, 2014) and extended by Heidegger to focus on *being* (Peters, 2013). The phenomenological focus on experience and the need to respond to the phenomena being explored (Dall'Alba, 2010) lends itself to education settings that are understood as situated and subjective, generating context-dependent knowledge (Flyvbjerg, 2006).

Flyvbjerg (2006, p. 5) argued for the necessity of a phenomenological understanding of expertise: "it is only because of experience with cases that one can at all move from being a beginner to being an expert". Subsequently, the identification of the emergent teacher skills requires commitment to the situated experience of the teachers being examined: knowledge and context are inextricably linked (Flyvbjerg, 2001).

Likewise, the pragmatic tradition offers an epistemological frame focused on the everyday; to the 'things themselves'. Moreover, pragmatism theorises out of social practices (Bacon, 2012). Dewey forwarded the idea that the realness of things and truth are synonymous (Dewey, 1963). The pragmatism of William James is described as a way of life rather than a traditional philosophy with abstract propositions (Rowe, 1996).

Though James was criticised by the founder of the doctrine, Charles Peirce, his work now rests alongside Peirce and John Dewey as the foundation for a more developed and richer tradition (Misak, 2007).

Pragmatism informs this study in that it solves philosophical problems like the construction of knowledge by "drawing upon the resources offered by our practices, and with reference to the consequences they have for our lives" (Bacon, 2012, p. 1). Dewey recommended accepting the "guidance of things in divining what knowledge *is"* (Dewey, 1963, p. 37). In one sense pragmatism is a reaction to the understanding of knowledge as belonging to a static universe (Dewey, 1963). Further, Quinton (2010, p. 3) described Dewey's work on knowledge as a "polemic against the 'spectator theory of knowledge'".

Acquisition of knowledge as active and exploratory

Dewey's pragmatism, drawing on Peirce and James, further frames knowledge through his understanding of the acquisition of knowledge as an active and exploratory process based on the conviction that "the conceptual instruments of thought are human constructions not independent Platonic existences" (Quinton, 2010, p. 2). This positions the knower as an "active being, an experimenter, not as a contemplative theorist" (2010, p. 3). The work of teachers in open plan spaces involves balancing traditions of practice with innovation. Identifying teacher skills will rely on the active experimenter drawing on resources of practice.

Dewey and Peirce each understood agents to be in a continuous context of inquiry, "where the decision to be made is a decision about what to believe from here, not what to believe were we able to start from scratch—from certain infallible foundations" (Misak, 2007, p. 3). According to Mizak the central concern of pragmatists is one of progressing from "present practice to future practice, where our very standards themselves may be thrown into question" (2007, p. 3). In this way, the identification of teacher skills will be achieved by drawing on teacher reflections and observations of practice as innovation and experimentation occur as part of the shift to new practices.

Ontological orientation

Constructionism

While the twentieth century saw the focus of phenomenology shift to the meaning of being (Lawlor, 2014), the core insights remain pertinent to education research. Despite the particular differences found in Sartre's notion of being as compared to Merleau-Ponty – stark being (as in Being and Nothingness) as distinct from finding being as transcendent self – it remains that the central tenet of their construct is that of 'the thing itself' (Lawlor, 2014).

Meaning making through shared experiential immersion

The epistemological frames are predicated on constructionist ontology. Constructionism asserts that reality is constructed (Lock & Strong, 2010) and given meaning through culturally constructed processes (Gergen, 2001; Jha, 2012). Fundamentally, the ontology asserts that "we are humans who are constructed through our inherent immersion in a shared experiential world with other people" (Lock & Strong, 2010).

Constructionism holds that knowledge is created by an individual's interactions and encountering their world and also co-created "through interactions with others within a specific community" (Jha, 2012, p. 172). Further, knowledge is "perspectival and value saturated" (Gergen & Wortham, 2001, pp. 125 - 126).

Inherent to the constructionist approach is the phenomenological understanding that the participants are the "experiential experts on the phenomenon being studied" (Rudestam & Newton, 2014, p. 107). This understanding allowed the study to proceed with the phenomenological and pragmatic traditions as its central framing device. The status of teachers as experiential experts of the open plan settings allows for the identification of relevant skills based on emerging practices.

The constructionist ontology is distinct from positivist approaches in that reality is constructed (Gergen, 2001). Positivist and post-positivist approaches, by contrast,

begin with a single reality and proceed by testing hypotheses (Wiersma & Jurs, 2009). The case study method employed in this study is informed by the constructionist insight. Social constructionism, as an extension of constructionism, understands knowledge to be established through social interactions; indeed, "all meaningful propositions about the real and the good have their origins in relationships. This is to bring into sharp focus the site of knowledge generation: the ongoing process of coordinating action among persons." (Jha, 2012, p. 173).

Historically, the broad currents of epistemology have led Bredo (2006) and others to acknowledge that educational research ought to borrow outlooks more consistent with humanities than natural sciences. That is, those accepting that the "relevant facts and relations change with time as social conditions change." (Bredo, 2006, p. 13).

After Dreyfus and Dreyfus (1986) Flyvbjerg (2001, p. 22) proposed that knowledge is composed of rationality and intuition, "Arational behaviour… connotes situational behaviour without the conscious analytical division of situations into parts and evaluation according to context-independent rules."

Key theoretical orientation

Teacher knowledge

The unique nature of the open learning spaces demanded a theoretical orientation elevating the supremacy of the agent's point of view (Bacon, 2012) through pragmatist and phenomenological epistemologies and a constructionist ontology. In this way teacher informants were critical to establishing reliable data.

The complex nature of teacher knowledge is acknowledged (Adoniou, 2014; Connelly et al., 1997; Desforges, 1995). Teacher knowledge is understood as an amalgam, changing and existing within a diverse and uncertain world (Santoro, Reid, Mayer, & Singh, 2013). It is characterised as practical and built through personal experiences (D. Hargreaves, 1997) though a related theoretical component must also form part of teacher cognition (Desforges, 1995; Verloop et al., 2001).

Verloop, Driel and Meijer (2001, p. 441) conceived teacher knowledge as "all profession-related insights". They acknowledged that teacher knowledge constitutes inextricably intertwining "components of knowledge, beliefs, conceptions, and intuitions" (2001, p. 446). This may include personal insights as well as connecting with other practitioners through communities of practice, theory knowledge and practical knowledge. Further, such knowledge may be implicit or tacit.

The intersection of knowledge of theory and knowledge of practice is accepted as occurring, primarily, in tacit form (Brown & McIntyre, 1993). This study undertook a range of method techniques to identify both practice and implicit propositional knowledge.

Where the theoretical lenses oriented the methodology the prototype model of expertise (Sternberg & Horvath, 1995) provided an opportunity to reference emerging trends in practice against recognised and established understandings. The adoption of a model of expertise informed by Sternberg's prototype model (Sternberg, 1998; Sternberg & Horvath, 1995), Collinson's triad of knowledge (Collinson, 1999), and Billet's qualities model (Billett, 2009b) framed the reading of teacher reporting on inhabiting and responding to the open plan learning spaces.

Structuration

Structuration theory (Giddens, 1984) provided a broad orientation for this study. Structuration is ontologically consistent with constructionism and provided a frame for understanding social interactions. It established the primacy of social practices or social systems (Giddens, 1976) as organised through space and time (Giddens, 1984).

Giddens' position elevated the agent to that of system creator through recursivity (Giddens, 1984). Recursivity, pre-supposing reflexivity, is the monitoring of ongoing social practices. Identifying the emergent skills of teachers required the examination of conventions of practice that are understood as social systems (Giddens & Pierson, 1998).

Structuration provided further clarity on understanding the bounded nature of agency (Giddens, 1976). In particular, the concept of enablers and constraints within this frame were pertinent to the examination of the school sites. The ideas serve as organisers when understanding the boundaries of agency. Likewise, the ideas of relational agency (A. Edwards, 2005) and nested agency (Prain et al., 2013) informed the reading of the case study sites. A detailed explication of these concepts is provided in Chapter 3.

Affordances

Affordances provided a further broad orientation to the examination of the school sites. Affordance theory (Gibson, 1977) accepts that physical surroundings offer agents numerous possible behaviours. This study accepts a reciprocity between the environment and the agent in order for an affordance to be actualised (Greeno, 1994; Turvey, 1992). It is also understood that affordances can be cultural and found in social interactions (Gibson, 1966; Melhuish, 2011)

Affordances were understood as the impact of the spaces on perception of possibilities and the actualised possibilities. In this way, attitudes toward the spaces and practices within them were a key focus of the data collection. Affordances are used to categorise those features or elements that impact teacher understanding and practice.

Affordance theory oriented the data collection toward examining the relationship between teacher perception and reaction to the environment, as well as the nested structures found in open plan schools. Taken together with agency, teacher actions are read as critical moments revealing emerging skills specific to open plan settings.

Characterising agency

Agency is characterised as individuals participating in the bounded milieu of the school: teacher practice involving pedagogy and social relations amongst peers and students. Following Giddens (1984), framing occurred through enablers and constraints. Agentic activity occurred in the realm of nested and relational agency. Within these

interrelated categories agency was an ongoing reflexive monitoring of the processes (structures) inhabited and continued by the teachers. These structures may be teacher driven or system constructs; pedagogically focused or social relationships between teachers and teachers or teachers and students. Environmental factors act as affordances further impacting teacher practices. Consequently, agency is impacted by the interactions of the agents with the physical environment. This occurs in the teachers' reflexive engagement with the teaching space.

Characterising teacher practice

The conditions of open plan learning settings engaged in creating twenty-first century learning experiences point to the need for a new kind of synthesis of practice. Practice within settings that are intentionally and productively disruptive – necessitating collaboration and innovation – suggest fundamental changes to the role of teachers. Metaphors and figurative language is an established part of the education environment (Clandinin & Connelly, 1998) with images such as 'sage on the stage' (A. King, 1993) conveying pedagogical intent and socio-cultural understanding of the teacher role. An overview of this role is possible through the identification of emerging skills and the examination of other forms of representation.

Research approach

The research method was informed by the understandings emerging from the review of the literature and the theoretical positions outlined above. The research question also determined the method. The epistemological and ontological positions suggested an apparent significance to understanding and being sensitive to context. Broadly, the exploratory case study (Yin, 2014) was employed within a qualitative frame. The general method is further informed by the ethnographic tradition.

Case study method allowed an examination of multiple sites drawing on the experiential expertise (Rudestam & Newton, 2014) of participants where knowledge is created and co-created (Jha, 2012) by interactions between agents necessarily bound to the experience of their world (Lock & Strong, 2010). The creation and ongoing nature of social systems – structuration (Giddens, 1984) – provided a scheme or framework

(Giddens, 1991) but required the study to theorise the unique (Gregson, 1989). The selected unit of analysis or case is bound by the conventions of case study method and established a clear uniqueness in its justification (Yin, 2014).

The epistemological consequence of limited and situational understanding (Bredo, 2006; Flyvbjerg, 2006) required a close examination to facilitate interpretation and judgment. Moreover, Dewey's account of knowledge as inquiry by active and exploratory agents (Quinton, 2010) concerned with future actions was best served by a case-based investigation. The make-up of teacher knowledge as both practical and propositional (Verloop et al., 2001) required a close-case investigation of practice and beliefs. Case study method is grounded in the phenomenon of the case (Yin, 2006) concerned primarily with the resources of practice (Bacon, 2012).

This approach allowed for close examination of the context(s) (school settings) while establishing a reliable method. A range of data collection strategies were used: open-ended interviews with teachers and students, direct observations (Yin, 2014) and structural artefacts (school-wide or nested constraints (Prain et al., 2013)). Yin (2006) identified good case studies as engaging a range of evidence.

The consequence in the epistemological shifts for education research is that there has been a movement away from absolutes or definitive and fixed foundational knowledge. Indeed, Bredo (2006) plots the shift away from fixed ideals as leading to the rise of pragmatism and a limited and situational understanding of social development. The importance of this for education is that foundations are limited to a "set of habits, conventions, and beliefs" (Bredo, 2006, p. 25) thereby rendering instances of practice unique and requiring "interpretation, judgment, and possible adaptation to fit its peculiarities to some more general pattern" (Bredo, 2006, p. 25).

The research approach of the salient literature

The methodological approach of much of the literature covering teacher knowledge can be characterised as qualitative or interpretive with a clear focus on concrete experiences (Ben-Peretz, 2011). Following the understanding of teacher

knowledge as experiential – inasmuch as it constitutes both practical and tacit theoretical components – this study adopted a range of qualitative techniques in gathering data. Such an approach is known to investigations of teacher knowledge generally (Connelly et al., 1997; Elbaz, 1981; Verloop et al., 2001). Several papers remain conceptual in nature (see: Cochran-Smith & Lytle, 1999) but draw on case studies for establishing conceptual themes.

Case studies are understood to be instructive in their own right and offer an opportunity for a vivid and full description of a situation (Elbaz, 1981). Connelly, Clandinin and He (1997) outline a range of qualitative field texts informing their study in teacher knowledge.

Case Study Method

"Context is central to understanding what social science is and can be." (Flyvbjerg, 2001, p. 9)

The case study method provided the opportunity to examine practice anchored to the context under scrutiny. The situated, subjective and complex nature of school settings means that the task of the researcher is to "explain the means by which an orderly social world is established and maintained" (Cohen, Manion, & Morrison, 2011, p. 298).

A case study offered the possibility of observing "effects in real contexts, recognising that context is a powerful determinant of both causes and effects, and that in-depth understanding is required to do justice to the case" (Cohen et al., 2011, p. 289). Further, as a form of social science research case studies are preferred when conducting research with a contemporary rather than historical phenomenon and where the researcher has limited to no control over the observable behaviour (Yin, 2014).

Case studies offer a method that allows for an in-depth examination of a case within a "'real life' context." (Yin, 2006, p. 111). Researchers describe case studies as achieving deep or thick explanations of a particular case (Rudestam & Newton, 2014; Yin, 2014) and this can be understood as a further justification for adopting case study method (Cohen et al., 2011).

Multiple-case study design

This study can be characterised as an embedded multiple-case design (Cohen et al., 2011; Yin, 2014). Each case study was conducted prior to cross-case analysis being undertaken. The advantage of multiple-site case studies is understood to be more compelling interpretations based on "greater ability to generalise across several representations of the phenomenon" (Borman, Clarke, Cotner, & Lee, 2006, p. 123).

The embedded multiple-case design avoids the risk of identifying only specific or one-off instances of behaviour. The different sites provide the opportunity to either replicate similar results or predict contrasting results for reasons that can be anticipated (Yin, 2014).

The ongoing interplay between data collection and data analysis is considered an essential component of the method (Yin, 2006) and offers further legitimacy to the choice of case study for this research project. Each case study informed the subsequent studies and allowed for refinement of data focus and collection.

Constructivist grounded theory

Constructionism as a meta-theory has enabled and supported the expansion of social science research to include and preference personal accounts, narrative and collaborative methods, as well as auto-ethnographies. Gergen (2001, p. 3) described this as a "revolution in qualitative research".

This study employed the general strategy of constructivist grounded theory (Charmaz, 2009; Glaser, 1978; Saldana, 2009; Yin, 2014). The appeal of constructivist

grounded theory included its consistency with pragmatism (Charmaz, 2009) and the phenomenological allowance of "multiple realities rooted in subjects' perceptions" (McMillan, 2000, p. 10). This is distinct from strict relativism. It permits the focus on experience and legitimises individual accounts. Moreover, the research process is understood to be reflexive with data analysis approached from the ground up being consistent with identifying emergent trends of practice (Charmaz, 2006). "The logic of grounded theory entails going back to data and forward into analysis. Subsequently, you return to the field to gather further data and to refine the emerging theoretical framework" (Charmaz, 2006, p. 23).

A tension is recognised between the constructivist grounded theory and classic grounded theory (Charmaz, 2009; Glaser, 2012; Hernandez, 2009). Still, researchers have established a constructivist tradition that "sees knowledge as socially produced, acknowledges multiple standpoints of both the research participants and the grounded theorist" (Charmaz, 2009, p. 129).

Constructivist grounded theory as a constructed reflexive process

The constructivist grounded theory approach understands research processes and products to be constructed. However, "these constructions occur under pre-existing structural conditions, arise in emergent situations, and are influenced by researcher perspectives, privileges, positions, (and) interactions" (Charmaz, 2009, p. 130).

Importantly, the reflexive process allows for a new theory to emerge from the data, as distinct from being discovered in the data (D. Barnett, 2012; Charmaz, 2009). The turn toward embracing the messiness of the world with its inconsistencies, tensions and contradictions is acknowledged.

Constructivist grounded theory understands knowledge to be created from engaging with empirical problems (Charmaz, 2009). Grounded theorists "select the scenes they observe and direct their gaze within them" (Charmaz, 2006, p. 23). Following this lead, Barnett (2012, p. 53) asserted, "theory is connected and linked to

practice through an analysis of the processes by which practitioners are attempting to resolve practical problems in their everyday world".

Constructivist grounded theory allows research problems to be a response to gaps in the literature, asking of specific questions, adoption of theoretical sensitivity to data and literature, and is based on a constructionist philosophy generally (D. Barnett, 2012; Hernandez & Andrews, 2012; Lempert, 2010). The research was conducted in a reflexive manner through interactions with interviewees and honing of questions and data collection in response to the emerging trends and literature.

Ethnographic methods

Ethnographic techniques have a significant presence in late twentieth and early twenty-first century education research (Anderson-Levitt, 2006; Goetz & LeCompte, 1984; Wiersma & Jurs, 2009) stretching beyond its traditional or home disciplines (Mills & Morton, 2013). The methods of ethnography have provided an opportunity for close, and detailed accounts of school settings with the intention of new generalisations (Street, 2014).

This study drew on an ethnographic tradition in order that meaning could be made of the actions of participating agents, a valid understanding of the local situation could be established, and behaviour observed across time (Anderson-Levitt, 2006). Charmaz (2006, p. 22) notes the particular difference between ethnography and grounded theory ethnography as being the priority grounded ethnography gives to the "studied phenomenon or process – rather than to a description of a setting". Further, the approach also offered a rich catalogue of established methods rooted, primarily, in a qualitative framework.

Consistent with case study method drawing on grounded theory employing ethnographic and qualitative data approaches, this study identified a range of data sources. The grounded theory approach meant "probing beneath the surface and digging into the scene" (Charmaz, 2006, p. 23). Broadly, each case study employed

techniques to gather the insider's perspective, examine social interactions and identify artefacts (Anderson-Levitt, 2006).

Sources of evidence

Sources were further categorised as documentation, interviews, direct observation, participant observations and artefacts (Yin, 2014). Drawing on a range of examples from the method designs (Anderson-Levitt, 2006; McMillan, 2000; Silverman, 2007; Yin, 2006, 2014) specific tools were utilised. The table below represents the source and collection method.

Table 3

Source of evidence and collection method

Source of Evidence	Realisation
Documentation	BEP Position descriptions Annual reports (school specific)
Archival records	Department records on SFO Staffing allocation to specific sites Student numbers Position descriptions
Interviews	Open-ended prolonged case study interviews – teachers Open-ended group interviews - students
Direct observations	Observation of teaching and general practice within the open-plan learning settings. (Formal and informal methods were employed).
Artefacts - cultural	Timetable data Curriculum organisation/structure Ideal lesson 'plan'

Note: (Adapted from Yin, 2014)

Role of researcher

The reflexive process of constructivist grounded theory emphasises the role of the researcher in the collection and analysis of data (Charmaz, 2006) and presents

particular challenges and risks for researcher positionality: asymmetrical power relationships (Lempert, 2010), researcher disclosure and theoretical orientation (Mruck & Mey, 2010).

Grounded theory is consistent with qualitative research generally where the context-specific nature ensures that the "researcher's role (is) one of inclusion in the situation" (Wiersma & Jurs, 2009, p. 14); however, grounded theory method extends researcher positionality through ongoing data collection and analysis (Lempert, 2010). It is not only a matter of description or reporting. Full participant status is eschewed for an increase in the involvement of the research inquiry.

Negating epistemic privilege

Epistemic privilege between the researcher and researched was negated through active give-and-take throughout the research process (Lempert, 2010). This was achieved in part due to my status as a member of the community of BEP teachers. My presence in the schools across fourteen years of employment - latterly as liaison for La Trobe University - positioned me as someone with working knowledge of the challenges and changes undertaken across recent years in the case study settings.

An example of give-and-take is seen in the sharing of literature and presentations to school leadership groups specific to the practice of team teaching. My own research *privilege* was shared with relevant groups across settings including BEP schools not utilised as case study sites.

Achieving researcher disclosure

Researcher disclosure was achieved in much the same way. My professional interest in the emerging practices within open plan settings was well known amongst the case study settings. Weekly visits to the school sites during pre-service teacher practicum, as well as professional development for mentor teachers, meant my professional interest was well established. I was careful to maintain clear and transparent intentions for my interest as a researcher.

Acknowledging prior knowledge and its impact on theory development is seen as critical to methodological rigor (Mruck & Mey, 2010). My relevant professional experiences and a candid reflection on my interest in the open plan settings served as declaration on this challenge to researcher positionality (Cutcliffe, 2000). The acknowledgment is provided in Chapter 1 and woven throughout the data collection and analysis where appropriate.

Teacher knowledge and reporting

The epistemological appeal of pragmatism for teacher knowledge is demonstrated through the consequentialist approach to understanding action. The pragmatist tradition shifts the focus from *a priori* knowledge to an anticipatory construct. The emphasis on any transaction becomes 'what-if' and the subject becomes future oriented (Elkjaer, 2009). This position is consistent with understandings of teacher knowledge as progressing from experience, pragmatic and context bound (Elbaz, 1981; D. Hargreaves, 1997) with an acknowledgement of the central connection between teacher action and knowledge (Clarke & Hollingsworth, 2002).

Consistent with the theoretical justification, phenomenology further focuses the study on the practices of the teacher: the phenomenon of the thing. The relevant practices are drawn from the literature informing definitions of rich, personalised learning experiences. Further, the literature providing guidance on practice within open plan learning settings was also used. The focus was honed after considerable time spent observing such practice and identifying those instances that could yield relevant data on teacher practice. The terms *practice* and *practices* are used throughout the study in order to achieve a distinction between the generalised account of teacher practice and the emerging activities undertaken as part of the broader engagement with the space and quality teaching and learning.

A broad outline of qualitative data is provided in this chapter. The particular foci have been selected through a combination of the methods described above. This is characterised as selective sampling and is in accordance with constructivist grounded theory.

Overview of the case studies

Three case studies inform this study. The case studies were conducted at three school sites spanning a two-year time frame. A brief description is provided of each site here along with an overview of the research schedule. A detailed account of each school is provided in Chapter 5.

Case study context

The first and second case study schools accommodate year levels 7 – 10. The third case study examines the senior campus. This school provides the senior qualification Victorian Certificate of Education (VCE) and Victorian Certificate of Applied Learning (VCAL). The BEP identified teachers, curriculum and sound design as categories demanding specific attention. The case studies allowed for close examination of the sites as teachers engaged with the open plan designs and responded through adaptions to curriculum and practice.

BEP participant schools

Most obviously, the schools were participant members of the BEP. The practices of teachers within each site provided an opportunity to address the central research question. The BEP schools were also chosen to target the phenomena under scrutiny (Stake, 2006). Moreover, it is recognised that case study research is generally iterative (Borman et al., 2006) with initial studies informing or orienting subsequent data collection and analysis. In this way, the three sites allowed for a thorough feedback loop within each study and across one another (Yin, 2014). It is recognised that the sites of Case Study 2 and 3 are distinct and this provided an opportunity to employ the replication logic central to multiple case studies (Yin, 2014).

Case studies across time and multiple sites

The progression of the case studies over time and across multiple sites afforded the chance to sharpen the themes and explore the tensions occurring in various settings. As per the iterative process central to the method initial case study findings informed the subsequent research. The findings for each case study informed the cross-

case analysis in the study. The justification for this is presented as part of the Method chapter.

The selection of three sites was also made in anticipation of the criticism of case study method being unable to make meaningful generalisations nor to establish a clear comparative advantage (Yin, 2014). A multi-case design provided an opportunity to somewhat negate both criticisms.

Participant selection

Participants were selected from targeted sites. Each site is a participant school of the BEP and constitutes a distinct case within a multiple-case design. Site selection can be characterised as theoretical sampling (Mason, 2002). The sites were selected on the basis of their status as open plan learning settings engaged in practices attempting to address the needs of twenty-first century learning. This also allowed the application of replication logic to predict similar or contrasting results (Yin, 2014) as part of the multiple-case design.

Following a two-phase approach (Yin, 2014), learning communities within each school were identified. In conjunction with the school Principal communities were selected against the broad criteria, selected from the literature, that they were reasonably progressed toward the goal of addressing personalised rich learning in a collaborative manner. This approach allowed for examination of perceptions and practices in a common setting within each case.

Where possible, respondents at each case study site were selected from a list of teachers willing to participate. Learning community staff numbers allowed for a range of experience, administrative responsibility, subject disciplines and genders to be represented. This ensured a breadth of perspectives avoiding single anecdotal findings.

Targeting innovative samples

The second data collection at site B is noteworthy. This involved the targeting of a particular teacher team engaged in recognised innovative practice (Cox, Waldrip, &

Prain, 2015; Lovejoy et al., 2014; Prain et al., 2014b). Participants were identified as engaged in practices and context salient to this study. School leadership personnel, responsible for curriculum development, were also interviewed. Theoretical orientation and earlier data analysis revealed the idea of 'potential practices', such as those at site B (Tellurian Secondary College), as being significant. Site B offered the opportunity to examine a realisation of practices that met the description of this potential.

In total, 14 professional staff and four students participated. Nineteen individual interviews were carried out while the students participated in a group interview. Observations at each site involved regular (two-weekly) half day visits across four terms over two years. Observations were also arranged around interview sequences across an intense two-week timeframe. A targeted, intensive observation was conducted as part of the study of Case Study 2.

Table 4

Data collection summary by site

Participants	Interviews	Classroom observation
School Site 1: Alluvial Secondary College		
4 teachers 1 each of novice, mid-career, accomplished and leading teacher	8 A double cycle separated by 12 months September 2012 and October 2013	25 hours loose observation across two distinct periods as part of the interview cycle
School Site 2: Tellurian Secondary College		
5 teachers 1 novice, 2 mid-career, 1 accomplished and 1 leading teacher 1 Assistant Principal 4 students (Year 8)	9 A double cycle separated by twelve months Teacher rosters changed with a reduced number of teacher interviews in cycle 2 1 group interview November 2013 and December 2014	10 hours loose observation across two distinct periods 4 hours close observation as part of the second interview cycle
School Site 3: Matassa Secondary College		
2 teachers 1 mid-career and 1 leading teacher	2 Single interviews August 2013	5 hours loose observation across a single period as part of the interview cycle

Assessing case study design

Assessing social science research has a recognised base. Commonly used tests are presented by Yin (2014) and others (Creswell, 2009; Creswell & Miller, 2000; McMillan, 2000; Silverman, 2007). The four key tests consist of construct validity, internal validity, external validity, and reliability. Construct validity is concerned with

the operational measures of concepts under scrutiny. Internal validity seeks to establish causal relationships. External validity is achieved by defining the domain to which the study's findings can be generalised. Finally, reliability is the demonstration that the operations of the study may be repeated creating the same results (Yin, 2014).

Tactics for achieving validity and reliability

The table below is adapted from Yin (2014, p. 45) and locates the tactics used by this study and the phase of research in which the tactic occurred.

Table 5

Addressing validity and reliability

Test	Case study tactic	Phase of research in which tactic occurs
Construct validity	Use multiple sources of evidence	Data collection
	Establish chain of evidence	Data collection
	Conduct member checks	Composition
Internal validity	Do pattern matching	Data analysis
	Do explanation building	Data analysis
	Researcher reflexivity	
	Address rival explanations/Disconfirming evidence	Data analysis Data analysis
	Use logic models	
External validity	Use replication logic in multiple case studies	Research design
Reliability	Use case study protocol	Data collection
	Develop case study database	Data collection
	Outline coding scheme	Data analysis

Note: Adapted from (Yin, 2014)

Achieving construct validity

Construct validity was addressed through a number of mechanisms at various stages of the research. The researcher lens and paradigm assumptions are seen as critical to establishing validity (Creswell & Miller, 2000). This research presented a detailed account and justification of qualitative framework based on constructionist

ontology informing pragmatism and phenomenology. Further, multiple sources of evidence were used to establish a broad database informing analysis.

Validity is further achieved through the provision of richness and depth of description (Cohen et al., 2011) or a thick description detailing both context and behaviour (Rudestam & Newton, 2014), as well as member checks and peer reviews (Creswell & Miller, 2000). A chain of evidence was also established through careful adherence to referencing relevant literature and database sources, as well as the inclusion of relevant documents in the appendices.

Achieving internal validity

Internal validity was addressed by identifying inferences and applying the procedure of triangulation and disconfirming evidence (Creswell & Miller, 2000). Disconfirming evidence, in particular, was employed as its procedure of identifying preliminary themes before exploring data is synchronous with replication logic preferred in multiple-case studies (Yin, 2014).

Researcher reflexivity (Creswell, 1998; Creswell & Miller, 2000) was also addressed through an open and candid declaration of researcher beliefs and prior membership of the sample population.

Achieving external validity

External validity was achieved through the examination of the range of generality (Borman et al., 2006). The limits of situated and context-dependent case studies in forming generalisations are acknowledged: small sample size and non-randomised samples leading to a narrow or unrealistic inferences (Silverman, 2007). Nevertheless, this study is not restricted to idiosyncratic observations. A variety of justifications are offered to establish a resonance that extends beyond the given cases.

Using multiple-case studies to establish generalisations

Multiple-case studies offer a counter argument for the scope of this study to make generalisations. Yin (2014) acknowledged the advantages of multiple-case studies

as being more compelling and robust. Further, the replication logic used as part of multiple-case design allowed results to be predicted as similar or contrasting depending on the context. The use of three cases with similar physical structures enacting different curricula to different year levels illustrated the design intent and allows for generalisations to be developed.

Analytical generalisation has been addressed in the multi-theoretical orientation and careful consideration of the components impacting practice in open plan settings: rich learning experiences, personalised learning, teacher knowledge and expertise, collaborative practice and teaming, as well as team teaching.

Silverman (2007) concluded that "the secret seems to be to substitute theoretical cogency for the statistical language of quantitative research" (p. 136). In this way, after Silverman (2007) and Alasuutari (1995), generalisations are tempered toward theoretically robust foundations for extrapolations with resonance.

Reliability, or replicability, is the use of transparent procedures to demonstrate reliable methods and valid conclusions (Silverman, 2007). This was achieved through adherence to protocols and the development of a case study database (Yin, 2014). Further, coding schemes were established to conduct data analysis (Rudestam & Newton, 2014).

Data collection

The researcher conducted all components of the research. A case study protocol was established. It included an overview of the study, data collection procedures, intended data collection scope, and data collection questions. La Trobe University Human Research Ethics Committee approval was gained prior to the case studies (R006/12). Likewise, DEECD ethics approval was gained prior to conducting the studies (2012_001501). School level permissions were also gained through the Principal at each case study site.

Informants were provided with documents outlining the intention of the study, the obligations of participants and procedures for withdrawal of consent. Consent forms were obtained and stored securely on-site at the university.

All interviews were recorded by digital device and transcribed by the researcher. Password-protected devices secure digital data. Transcription occurred a short time following the interviews. Aliases were used in the transcribed interviews and subsequent reporting of data.

Related materials such as position descriptions, school level data on staffing, student profile, student population numbers, as well as school-wide lessons plans were obtained from school administration staff. Artefacts such as timetable and rooming grids, along with architectural schemes and concept plans for each school were also obtained. Again, digital material was secured on password-protected devices.

Data analysis approach

Data coding and analysis was conducted across all case study sites using the following approach.

Constructivist grounded theory coding

Within constructivist grounded theory the coding scheme is understood to "shape an analytic frame from which (to) build the analysis" (Charmaz, 2006, p. 45). This facilitated the researcher to generate a theory, an "abstract analytical schema of a phenomenon" (Creswell, 1998, p. 56), relating to the open plan learning settings under scrutiny.

Social science writing is recognised as occurring as a process embedded in the data (Silverman & Marvasti, 2008). The process of grounded theory is to "1) compare data with data from the *beginning* of research, not after all the data are collected, 2) to compare data with emerging categories, and 3) to demonstrate relation between concept and categories" (Charmaz, 2006, p. 23).

Dual cycle coding process

To that end, a dual cycle process of coding was employed. The combination of open, focused and theoretical coding types is common to constructivist grounded theory (D. Barnett, 2012; Evans, 2013).

First cycle coding methods

First cycle coding methods consisted of descriptive coding for documents (position descriptions, timetable and room grids and field notes/observations) and initial coding, used for interview transcripts.

Descriptive coding was used to establish the "basic topic of a passage of qualitative inquiry" (Saldana, 2009, p. 70) thus allowing for a broad category to emerge using a simple vocabulary.

Initial coding enabled a close reading of the data using an open-ended approach (Saldana, 2009). Such an approach allowed the study to explore directions established in the literature while remaining open to theoretical directions suggested by the data. This preceded the later manoeuvre of establishing core conceptual categories (Charmaz, 2006; Glaser, 2001).

Second cycle coding methods

Second cycle coding methods were used to reorganise and reanalyse data from the first cycle to develop a coherent synthesis (Saldana, 2009). Saldana (2009) explained that this synthesis aims to establish a smaller or more select list of broader categories, themes or concepts.

Memoing (Lempert, 2010) was used as a tool in conducting the reflexive approach to open and focused coding. Focused coding methods were used by this study to establish broad categories "without distracted attention… to their properties and dimensions" (Saldana, 2009, p. 155).

Theoretical coding is the process of specifying possible relationships between categories established through the focused coding process (Charmaz, 2006). Theoretical codes function "like an umbrella that covers and accounts for all other codes and categories formulated thus far" (Saldana, 2009, p. 163). This study employed theoretical coding in the later stages of analysis to formulate abstract concepts acting as umbrellas or themes. These abstracted categories emerged from the data categories (Glaser, 2013) and allowed variations and complexity while weaving the narrative toward coherence (Glaser, 1978). The method of constant comparison was employed to ensure fidelity to the data (Glaser, 2001).

Coding example

An example of this coding process is taken from the results of Case Study 1. The school site of Case Study 1 is a participant member of the BEP, making it an obvious sample providing access to teacher practices salient to the research questions of this study. Alluvial Secondary College (SC) had been operating in open space layout for two years prior to commencing research. It had adopted a range of curriculum and practice adaptations in response to the space and in an attempt to produce twenty-first century education.

A detailed account of the Case Study is provided in the following chapter. For the purposes of providing an illustrative sample of coding it is enough to sketch a brief outline of the adaptations. The school arranged four communities of roughly 200 students into distinct locations. The buildings each resembled the design thinking featuring open plan, flexible furniture, accessible ICT infrastructure, and shared facilities. The teaching profile of the Case Study community included 12 teachers including 2 leaders. Some specialist teachers shifted between communities and some specialty subjects – Physical Education and Technology – involved students using different parts of the school.

The school opted to schedule teaching into three extended periods of time across the day. Further, English and Humanities combined to joint-classes pairing

teachers and subjects in a single up-scaled space. The early response also saw the initiative repeated in Mathematics.

It was recognised that the school was in an early phase of adaptation and that results could shape subsequent research at this site and the sites of Case Studies 2 and 3. Subsequently, open-ended interviews focused on teacher practices asked about the 'gains' (and 'losses') of teaching in open plan learning environments.

Sample question from first round of interviews

Q4. What do you see as the gains of the learning community open plan setting?

Before, it used to be one size fits all: we know what we're doing and the kids are just going to learn it. Now there's the constant questioning and how can we change what we're doing to meet the needs of the kids. (Teacher D)

Sample coding of interview responses

A close reading of the above response established initial coding such as "one size fits all", "constant questioning" and "meet the needs of the kids" (Teacher D), closely reflecting the data (Charmaz, 2006). The further and repeated use of the term 'flexibility' suggested a reasonable focused category – flexibility – that arose from the data and allowed for meaningful clustering of Initial codes. Progressing from code to category is not unknown to grounded theory processes (Charmaz, 2006).

A further example is seen in the coding of observations. Observations of practice in Alluvial SC consisted of descriptions of teacher actions during a lesson. An incident-to-incident approach was adopted (Charmaz, 2006). This allowed the researcher to

compare concrete behaviour to initial coding and focused coding arising from interview transcripts. Further, the observation coding informed the second cycle coding in an iterative loop. Such non-linear coding is recognised as part of the procedure of the emergent process (Charmaz, 2006).

Theoretical coding method suggests the development of a broad category (Glaser, 1978). 'Adaptability' serves as a theoretical code that weaves the story back together (Glaser, 1978). This theoretical coding is recognised as substantive and linked to the "micro-sociological perspective on social phenomena emphasising the role of human action and agency" (Kelle, 2010).

Table 6

A sample of progression of coding categories

Initial + Descriptive	Focused	Theoretical
Interviews: More than "one size fits all" "meet the needs of the kids"	Flexibility	Adaptability
Classroom practice: Students seeking assistance at all times from various disciplines and at different ability levels.	Pedagogical agility & Discipline knowledge	
Team teaching		

Chapter 5 Findings and Case Studies

This chapter provides a description of the individual case study school sites followed by the findings of each. Employing the coding method outlined in the previous chapter, the data is used to establish themes or theoretical codes and conceptual categories.

Case study outline

This research is informed by three case studies. The case studies were conducted across three sites over 24 months. The selection of the sites was based on several factors. Importantly, the sites addressed Stake's (2006) requirements of relevance, diversity of settings, and opportunities to learn about complexity and context.

BEP: Design facilitating educational change

The BEP states that "the regeneration of junior secondary schools in Bendigo (Victoria, Australia) is based on contemporary design principles that improve learning outcomes for students ... with design features to allow increased student access, use and ownership of the learning environment" (Department of Education and Early Childhood Development, 2006, p. 27). A key part of each BEP school design is the learning neighbourhood, a large open space accommodating 100-150 students, and staffed by a team of teachers. The case study sites of Tellurian Secondary College and Alluvial Secondary College each have four buildings, or communities, each containing two or four neighbourhoods. Matassa Secondary College has adopted an English community building using similar principles. These are described in detail below.

Each of the case study sites responded to the design impetus in particular ways – though the two junior secondary schools share many similarities. Further, each site has engaged with built space to design curriculum initiatives specific to their school context. The case studies explore these responses.

Site A and B: Alluvial Secondary College and Tellurian Secondary College

Both case study sites A and B are made up of years 7-10. Both schools are engaged in providing curriculum made up of Victorian Essential Learning Standards (VELS) and the Australian Curriculum (www.australiancurriculum.edu.au; http://ausvels.vcaa.vic.edu.au).

The open nature of the neighbourhood design affords teachers working either one-on-one, with small or large groups. Teachers are part of the neighbourhood and can be sighted and accessed at any time by students, and are expected to work in teams. Other design features of each building include integrated wireless and fixed computer spaces, studio classrooms for up to 25 students, tutorial rooms, and staff and meeting areas. Furniture that can be moved and used flexibly in a range of layouts is provided. The learning environments are characterised as flexible, meaning they can accommodate a range of teaching and learning approaches, including interdisciplinary inquiry-based, personalised, and community learning.

Site C: Matassa Secondary College

The specific response of the senior setting is an adaptation of the earlier design plans of the BEP junior secondary colleges. Similar features can be seen in the open plan English building with a focus on community: all English classes are conducted in the space, student friendly breakout zones for study and socialising, high visibility between classes and staffrooms with easy access to teachers. The space is rich in technology supported by wireless networks for a range of personal devices. Furniture is easily moved and encouraged to achieve a customised layout.

The learning environment of the senior secondary English building is also characterised as flexible, similarly allowing the provision of diverse teaching and learning strategies. Though the senior context establishes particular restraints there is still a move toward a mixture of individual, personalised and community based learning (Department of Education and Early Childhood Development, 2008).

Case Study 1: Alluvial Secondary College

Alluvial Secondary College (SC) was chosen for a number of reasons. In particular, the school had committed to establishing a community based learning model prior to the completion of the specialised buildings. The community had been operating in open spaces for two years at the time of the first interview. The community under examination commenced in a modified open plan space that once housed the library. A minor conversion allowed the space to act as a pilot for the school as it considered the broader full-scale shift.

Contextual features

The student population constituted a range of socio-economic backgrounds with a large percentage of students in the lower quartile. The targets of the BEP were particularly relevant to the student cohort at this school. Moreover, the staff profile contained a mixture of experience and the community structure meant a broad range of disciplines was present in a single community.

Alluvial SC delivers years 7 – 10 to a total enrolment of 587 students made up of four communities. The community under study consists of 145 students. Of note is that each community is built to house 220 students. Each community was made up of all year levels with a close-to-even spread across the four years.

Government funding for schools is composed of two parts. The first is a standard resource allocation per student. The second is composed of equity funding. The Student Family Occupation (SFO) determines this. The socio-economic status of students is understood to be an indicator of student performance, particularly as it relates to the SFO (State Government Victoria, 2015).

The SFO density is calculated by the sum of multiplying the number of students in each category by the weighting of that category, divided by the total number of students. The SFO for Alluvial SC is 0.569. The state wide SFO density for mainstream schools is 0.513. A final SFO entitlement is not necessary for this study. The status of the

SFO density at Alluvial SC indicates a school population of mixed socio-economic status tending toward the lower quartiles.

The teaching profile of Alluvial SC totals 43 teachers and 12 Education Support (ES) staff. The community being examined had 9 permanent teachers including two leaders. Each leader held duties specific to curriculum and student management. Another 3 teachers moved between this as their home community and other communities. Several teachers also taught into specialty programs across the school such as physical education and science.

Outline of data: collection, participants

Data consisted of two interviews with five teachers covering a range of experience in the open plan settings and level of experience generally. The second set of interviews was conducted twelve months after the first. The first set of findings informed the second interviews with clarity being sought around particular themes emerging from the data.

The participants included a novice teacher (3 years), a mid career teacher (7 years), as well as two experienced teachers (28 and 30 years). The second holding a leadership position for eight years, including leading the transition into the open plan setting.

The teachers were chosen to represent a broad discipline focus: English, Humanities, Physical Education and Science. Each teacher was asked to reflect on their teaching experience and make comparisons between traditionally arranged settings and the open plan arrangements. The interviews sought comparisons on the role of the teacher, the team and leaders. Where the novice teacher had no experience in traditional settings, perceived understandings of differences were deemed sufficient.

The physical make up of the school

The physical make-up of each community at Alluvial SC was essentially the same. The diagram below (Image 1) illustrates the dominance of large open teaching spaces

emphasising high visibility. The large spaces could accommodate up to three classes at one time. These are adjacent to breakout zones and two enclosed teaching spaces for limited numbers. The diagram also illustrates the open nature of staff offices, preparation areas and social spaces keeping all staff and student activities within close proximity. Teachers and students also share toilets, cooking and casual spaces.

Interestingly, the entrance atrium has evolved to house a table tennis table as well as a selection of couches, low tables and computers. The table tennis table was suggested by the students and negotiated with the Physical Education teacher in the community. It has since become home to tournaments and is the new waiting area for students who catch late departing buses.



Figure 4 Alluvial Secondary College floor plan [Used with permission]

Each learning community within the school exercised a degree of autonomy, meaning the particular context of the case study was unique. However, consistency was maintained across communities through weekly leadership meetings and assessment schedules. Likewise, a consistent approach to lesson plans was considered necessary for the early stages of the setting and this provided a degree of predictability across the school.

An account of open plan practice: early phase adaptation

A detailed account of the practice occurring within the up-scaled open plan setting captures the complexity of the altered setting. Case Study 1 provided an opportunity to document the challenges specific to the practice within the open space and to identify those practices that were different and those that were not. Case Study 1 captures the tensions within the complex settings and provides an early phase sample of responses to open plan settings.

The early phase adaptation to the up-scaled open plan setting can be characterised as tentative. The curriculum response made attempts to utilise the possibilities of the space by organising communities to consist of all four year levels, altering the timetable to three extended sessions broken by a small and large break, and grouping teams of teachers and pairing same or similar classes. A further response is seen in the increased focus on pastoral care with the shift in focus and time allocation toward an Advisor program with teachers taking a significant lead.

Data in this early phase timeframe relied on teacher reflection as to the possibilities and affordances of the space where practice was not always providing the concrete instances of the perceived potential. This scenario revealed considerable differences in teacher understanding of the spaces, beliefs about teaching and learning, and required skills. Observation data verified the different levels of take-up and competence specific to practice within the spaces.

Case Study 1 provided an early phase response to occupying the up-scaled open plan sites. The data collection provided early insights for difference in teacher practice,

salient moments expressing teacher knowledge and revealed the challenges of representing understandings of affordances and 'potential' practices alongside the ongoing demands of daily school life.

Early phase adaptation: reshaping the timetable and team teaching

A significant adaptation to curriculum in Case Study 1 is expressed in the timetable. The school organised its timetable into three large blocks. This represents a substantial adaptation providing opportunities for extended periods of learning amongst all subject disciplines. The adaptation commenced prior to the shift into the new spaces but was prompted by the need to prepare for the type of curriculum provision made possible by the spaces.

Further curriculum response at Alluvial SC included the combination of English and Humanities classes, along with two classes of Mathematics. In each case the combination were to utilise tem teaching. The initial response saw the combination of two classes at the same year level. In the case of English and Humanities it consisted of both subjects. Mathematics combined two classes. The classes occurred in a single open space with two teachers negotiating planning, enactment and assessment. At times, English/Humanities or Mathematics teams were required to combine in the same open space with a third subject. This may have been a language class or Physical Education theory.

The commitment to synchronised teaching in teams meant the space was often shared with a third, stand alone subject. Further, the variation in perceived competence led purposely paired teachers to conduct distinct classes enacted in parallel as opposed to in combination. The occurrence of the latter did not endure and single Mathematics classes tended to find their own separate physical zones. This was followed by an abandonment of the strategy by the Mathematics department in the first year of the new space.

The combined English/Humanities classes used the joint allocation and longer teaching time to conduct extended investigation units and encourage self-directed work

practices for students. A variation in practice was also seen in the use of two teachers to divide the number of students unevenly. Where one teacher assumed responsibility for a large, double class the 'free' teacher could roam the space and work with individuals or groups.

The early phase adaptations of nascent practice meant a variety of solutions were trialled. The school responded to the tensions emerging from joint teaching, non-aligned classes by implementing an ideal lesson plan. The plan was designed to synchronise practice with a structured approach to lesson enactment in the same open spaces. The plan provided a clear timeline breakdown for each block of teaching time. The emphasis on synchronised (short) teacher-driven instructions followed by (extended) student-oriented group work activities and ending with teachers facilitating brief reflection exercises meant that the various class groups across the open spaces were in the same mode thus minimising disturbances through noise and student actions.

Leaders in the community of Case Study 1 also undertook modelling for those teachers who requested help or who they identified as needing assistance. The public nature of practice in the highly visible settings resulted in the leaders implementing a 'no-yelling' rule in the community. The leading teacher in the study reported a marked increase in curriculum-oriented work for that position. This represented a shift away from a behaviour management focus prior to moving into the open plan space.

Early phase adaptation: (non) allocation of space

Further complexity is found in the allocation of the space. Case study 1 opted to not formally allocate the physical spaces to particular teachers or subjects. The justification for this consisted of a 'fit-for-purpose' strategy. Further, it was an attempt to prompt teachers to consider the need prior to engaging with the space. This meant that students and teachers developed conventions such as meeting in a common area prior to deciding the exact location for the lesson. A longer-term convention usually prevailed with teachers and students establishing an unwritten space usage pattern.

The spaces were negotiated as per the perceived requirements. The smaller studio spaces were negotiated for viewing of film texts as the open spaces offered no barrier to the sound, large-scale visuals or age-inappropriate material. Particular spaces such as the multi-use Da Vinci Studio, designed to co-house Science and Arts, required a formal timetabling arrangement to ensure both departments received equal distribution of the resources.

This represents early phase adaptation. Teachers indicated an understanding of the potential of the multi-use studio beyond traditional models but were also concerned with a fair distribution of the access. The leaders in particular saw this as a compromise but indicated the need for a shift in thinking around how Science and Art could be offered before innovating on the use of the space.

Intensification of the daily professional experience

The early curriculum and pastoral adaptations to the open space resulted in the intensification of the daily experience through substantially higher levels of professional exchanges. The types of interactions occurring between teachers were more frequent and required the negotiation of resources, space, pedagogy, and student behaviour management. Teams engaged in joint practice were required to find time to structure learning sequences, plan lessons, reflect, and consult on marking and reporting. The staccato take-up of the invites for team teaching and necessity of non-aligned scheduling meant that time spent teaching also required a degree of negotiating with colleagues.

The intensification of daily work routines was consistently reported and readily observed during site visits. Interactions with students were also intensified with high visibility and shared spaces dissolving once firm distinctions between formal teaching time and non-scheduled, informal interactions. Inasmuch as the pastoral program sought to achieve a sense of community, the increased accessibility of teachers throughout all parts of the space at (almost) all times of day meant relationships with students were reported as being enhanced through this intensification. Teachers reported this as a clear positive but one that came with extra pressure.

Under the intensified conditions of open plan spaces the pressures for a structural overlay are easily determined. The shared spaces and increased interactions between teachers and with students at Case Study 1 were seen as requiring particular support. Organising time and space through scheduling and alignment constituted a school level response. This led to further pressure based around curriculum design and enactment as well as informal interactions. Further responses can be seen in selection of team teaching and the reported distribution of work for community leaders. In some instances, such as the Mathematics Department, the joint class initiative was stopped to allow for time to reflect and devise a new approach.

Early phase practice: Normalising adaptations

Interviews with teachers in the early phase of occupancy indicated a willingness to quickly adapt daily practice and absorb necessary changes. What appeared significant changes to practice to the researcher were reported as already normalised. This indicates a high degree of adaptability based on the necessity of ensuring the running of a school from day to day. The process of data collection had to be sensitive to a range of possibilities. Informant responses may indicate a lack of reflection time, a lack of reflective capacity or an unwillingness to share professional insights in such a forum. The quality of interview responses eliminated the first two possibilities and subsequent questioning about particular moments of practice allowed for an expansion of thinking by the interviewees. Further, the development of themes and exploration of insights across two further Case Study sites allowed for professional insights to emerge and inform the study.

Establishing themes

Case Study 1 represents an early phase response to teaching in up-scaled open plan learning settings. The interview responses and researcher observations provide themes for further exploration and allow for the identification of sites engaged in an advanced phase adaptation to the open plan setting.

The themes of the findings are presented in the table below. The first cycle coding provided a close treatment of the data. Second cycle methods were used to determine coherence through initial themes (Focused coding) and, in turn, to theoretic or analytic codes (Saldana, 2009).

Table 6

Data analysis: focus and theme (Alluvial Secondary College)

	Focused categories & literature reference	Final analytical coding
Teacher perceptions of the affordances of open space	Openness and flexibility (Boddington & Boys, 2011; Boys, 2011a; Gulson & Symes, 2007)	Flexibility of space
		Increased visibility and scrutiny
	Rethinking conventional organisation of space and time (McGregor, 2003a, 2004b; Melhuish, 2011; Usher, 2002)	De-emphasis of hierarchy
Teacher reaction to open space	The constraints of routine (Cooper, 1981; Desforges, 1995; Wallace, 1980; Woolner et al., 2012)	Collective practice
		Team orientation
	The influence of context (Billett, 2009a; Deed, 2015a; Hoekstra & Korthagen, 2011; Otteson, 2007; Wilson & Demetriou, 2007)	Interactions and authority

Note: (Alterator & Deed, 2013)

While the expansion of the research - a second set of interviews and two further sites - saw development of the categories, the essential constitution of focusing on teacher perception and reaction remained consistent.

Findings:

The data revealed that the affordances were understood as flexibility of space, increased visibility and scrutiny, and a de-emphasis of hierarchy. Further, theoretical

coding saw teacher reaction emerge as collective practice, team orientation, and interactions and authority.

Teacher Perceptions: Affordances

Flexibility

Flexibility was reported as being evident within the space itself. The traditional, or regular, packaging of time and space was directly subverted by the school-wide adaptations of the timetable and subject groupings and challenged by the possibilities of practice evident in the open plan buildings.

> Its both flexibility of delivery and flexibility of facilities. We don't have timetabled areas other than science and art. …it ensures that teachers do think about what they're doing before they go into the space. We think that's really important. It's easy to go to a space and then decide what you're going to do if you always go to that space. (Teacher A)

> I think things through more. You're thinking of the space and where you want students to be… a bit more pre-planning. (Teacher E)

Flexibility was seen as an inherent feature of the open plan buildings taking expression through the arrangement of resources and in teacher practice. Flexibility was generally reported to mean a wider range of options for teachers with a focus on team teaching at this site. There were no single pedagogical preferences though student-oriented strategies featured where characterisation of practice was sought.

Where planning and marking occurred the English Department still played a role. Teachers reported needing to conduct this work across communities despite the implementation taking place in their home community. Finding the time to prepare and reflect in the discipline specific teams also required flexibility.

There was a reported increase of teachers approaching leadership to negotiate trialling new methods of using the space. These were not limited to subject categories

nor to the English-Humanities combination that had persisted from the outset. This may indicate an increased understanding of the potential flexibility provided by the spaces and a level of comfort within the bounds of the structural overlay in the school.

Visibility and scrutiny

The visibility of teachers was achieved by the positioning of staff desks, resource rooms, and tearooms adjacent to the open plan teaching spaces. Extensive windows and shared facilities ensured a high degree of visibility for all facets of teacher practice. As a result, teachers reported substantial levels of scrutiny.

Teachers reported the visibility and scrutiny impacting on relations with students and colleagues. Where high levels of informal interactions were reported between the teachers and students, there was an expectation that the teachers were 'performers'; they were always on show. Teachers reported being called on by students in different subjects as they walked past during times they were not scheduled to teach. It was also relayed that this occurred between students and other teachers when they were formally scheduled to teach the class.

Likewise, the scrutiny meant that practice was visible to colleagues and other students. This scrutiny resulted in teachers relinquishing autonomy. This was reported as true of team teaching arrangements as well as non-team based, but highly visible, single teacher practice.

De-emphasis of hierarchy

When considered as a whole, these factors also contributed to the de-emphasis of hierarchy. This can be characterised as the 'democratisation' of the school space (Alterator & Deed, 2013). This is the result of the increase in frequency of communications between teachers and students as well as between teachers. Teachers are constantly available to students. This includes non-teaching time and when formally responsible for a class.

> You can have the flexibility of just walking into their (other teachers') community and having a conversation with them… easier walking into an open space rather than going into a traditional style classroom, it's just less invasive. (Teacher C)

Interactions between teachers increased as a result of the proximity and visibility of the open spaces. Moreover, the ongoing – often daily – negotiation of resources, including the teaching space itself, centred control of the ongoing practice firmly around the teachers. Previously, a central administrator would have made such decisions.

The shift away from deferring to a leader for critical decisions also contributed to the de-emphasis of hierarchy. Teachers opted to make these decisions themselves by virtue of their volume and the sense of ownership. Involving a formal authority was reported as being a "waste of time" (Teacher B).

Informants reported a consequence of the fluidity of space was increased support from colleagues. Whereas traditional spaces were understood to require formally arranged moments of space and time to achieve such things as professional development, the flexible spaces allowed a more fluid approach. The open spaces afforded opportunities to share expertise.

An example of this is seen in one teacher reflecting on learning how to use a piece of science equipment: "He just took the opportunity to show me. No planning. You couldn't really do that before. You would have to go out of your class. Knock on their door. Wait for an answer. Come in and ask." (Teacher B)

The affordances reported by the teachers at Alluvial SC indicated a complex interplay between the physical setting, structural overlays implemented at school level, increased interactions through proximity and visibility leading to scrutiny and a reported shift in the unfolding of authority, relationships and professional identity. The

specific reactions of teachers as they adjusted to these affordances will now be reported.

Teacher Reaction

Teachers at Alluvial SC were required to adapt practices in response to the affordances of the vastly altered teaching spaces and arrangement of physical and non-physical resources. These adaptations, along with teacher perceptions, combine to encompass teacher reaction. Teacher reasoning is understood within a pragmatic epistemological framework. Within this tradition the pragmatic maxim explains that the "meaning of a concept is a matter of the practical effects of acting in accordance with it" (Bacon, 2012, p. 3); teachers make their thinking visible through practice.

Collective practice

Teacher teams were a necessary component of the structural overlay implemented by the school. Informants reported adaptability and flexibility as critical to the success of measures such as team teaching. Teacher C described success as a "willingness to adapt and adjust". The work of incorporating other teachers presented particular challenges, these included a sense of shared responsibility and adapting to the presence of other teachers, "One of the challenges is to be able to incorporate another person in to my teaching experience" (Teacher A).

Adaptability and flexibility were reported as essential to the success of responses such as team teaching. The opportunities afforded by the open spaces relied on teachers adopting a degree of flexibility in an understanding of teaching. Further, adaptable practice is required for success.

Team orientation

Contrasted with the prevalent orientation toward individualism (Elmore, 2007; D. Hargreaves, 1980; Lortie, 1969) team orientation is the result of increased accountability due to visibility and the team based approach to planning, teaching and assessment. Teachers reported that working within the open spaces presented particular demands:

We're more accountable too because we can all see each other. (Teacher C)

In the traditional model some would go off on their own tangent – it was more ad hoc. Now it is more accountable and the curriculum is getting more robust and rich because there is more sharing. (Teacher E)

Not only is the use of space necessarily deliberate, the joint teaching ensures that planning occurs collectively. As well as the paired teacher-teams working to plan the use of the space, the presence of other teachers in the space demanded collaboration across all users. An orientation toward team is seen as a necessary feature of practice in the open space:

It's like a village. We're all responsible for the kids in our community. (Teacher E)

A further consequence of visibility was reported as being the changed understanding of authority. The high levels of visibility impacted capacity for teachers to maintain surveillance. This was enhanced by the presence of many teachers in the space who could monitor students at all times. Informants described this as providing increased freedom for teachers.

Interactions and authority

Further shifts in the understanding of authority occurred as a result of the increased frequency of interactions and negotiations between teachers. This saw a redefining of roles and expectations. The impact of open spaces appears to play a significant role. The open space is described as "everybody's" and as fostering a community feel. The sense of ownership is palpable.

The increased interactions and sense of community can be seen in the decision to operate without designated class spaces. In not being assigned a single space, teachers were required to negotiate the space with regular frequency. The decision

demanded negotiations but is simultaneously a response to ownership of the community.

> We just negotiate. …it seems to work perfectly. The informal negotiations happen a fair bit. And you've got a small enough number of people that it works. (Teacher C)

The second round of interviews revealed little changes in teacher perception. A general understanding of the affordances was maintained as categorised in the first set of data. Flexibility, visibility and scrutiny remained dominant themes. Teacher reaction had altered slightly with instances of team teaching decreasing. It appeared that combined classes continued to prevail where there was enthusiasm for the practice.

Interestingly, the earlier presence of an ideal lesson – designed to structure often formless, noisy beginnings and ends of lessons – seemed less significant. Though, it is noted that the ideal lesson maintained a presence in practice. The normalisation of the practice may have played a role in the lack of presence in interview data.

Concluding comments

The practice of teachers in the up-scaled open plan settings of Alluvial SC reveal a dynamic relationship between the physical setting, structural layers and teacher practice. This interplay is evident in the early phase adaptations of teachers' work in Case Study 1. Team based teaching saw some experimentation with staff roles during the lesson and necessarily required greater levels of collaboration through planning, reflection and marking placing considerable demands on time. Student-oriented pedagogies dominate where team teaching occurs. The increase of visibility and shared, aligned practice has amplified a sense of accountability.

Interestingly, where teachers were not involved in joint teaching, affordances and adaptations were limited to non-pedagogical fields. For instance, a stand-alone subject like French does not involve team teaching. This meant the reporting of

affordances was focused on the informal interactions with students outside the scheduled teaching time. Conversely, there was not much perceived variation in practice during formal teaching time. The impact of increased interactions and the breakdown of teacher roles throughout the class was seen as impactful but generally positive or not making much difference.

The interactions between teachers and with students involve an ongoing series of connections ranging from critical and practice-based to informal and pastoral. This too has exaggerated the volume of work throughout the day for both scheduled and non-scheduled times. The impact of these interactions has seen ideas of authority change with a blending of responsibilities and an increased likelihood of teachers tackling concerns themselves rather than deferring to a formal leader.

The response of teachers in the early phase of adaptation appears to centre on the structural overlays and, apart from team teaching, has not penetrated to vastly different pedagogies or models of practice. Nevertheless, Case Study 1 does provide a clear sense of the pressures present in the up-scaled learning environments. The traceable variations of practice and curriculum models have been outlined above and have established theoretical codes informing the second and third case studies.

The first case study sharpened the focus of the study. Subsequent cases were identified against a criterion of clearly addressing the quality teaching and learning experiences outlined in Chapter Two. The passing of time between case studies also meant there was a naturally occurring maturation of practice within the schools. In this way, Case Study 2 and 3 represent mid to advance phase responses to up-scaled open plan settings.

Case Study 2: Tellurian Secondary College

Tellurian Secondary College (SC) was selected as a further sample of a BEP site yet contrasting on several levels with Alluvial SC. The site is distinct from Alluvial SC in year level structure, curriculum design and, more subtly, physical structures. Further, the school has occupied the open plan settings for four years at the time of

commencing the study. In this way, it allows for focus on advance phase practice within the BEP schools.

Contextual features

A particular justification for the site of this case is offered in the innovative mathematics curriculum program. Tellurian SC represents a complex and advance phase response to the affordances of open plan learning environments and twenty-first century learning.

The student cohort profile at this site is similar to Alluvial SC with a large portion of the population characterised as low socio-economic status. This is reflected in the SFO. The SFO density at Tellurian SC is 0.541 with the state wide SFO density for mainstream schools at 0.513. Again, a final entitlement for this site is not required for this study. The SFO remains a reasonable indicator for student cohort profile.

The teaching profile of Tellurian SC in 2014 was slightly smaller given the lower student numbers. Though the total staff remained consistent (63) a drop in Education Support staff occurred (26 from 27). The community under scrutiny had 13 permanent teachers including one leading teacher. The Education Support staff member was located in the community on a 0.5 loading. Again, several teachers moved between communities.

Outline of data: Collection and participants

Data collection at Tellurian SC constituted two distinct data collection periods separated by thirteen months. In this period the school moved from four communities of single year levels to communities combining the four year levels (7-10). The adjustments at school level are taken as the ongoing responses to occupying open plan settings. In each instance the focus of the data was the Scintilla mathematics program. The make up of the community at each point of data collection is described below.

The first data collection at Tellurian SC occurred in November 2013. At this point the school was made up of four communities responsible for a single year level each.

This makes the site context particular to this community. In 2013 the total student enrolment was 823. The Year 7 community was made up of 208 students. Students received the majority of learning within the community building. Teachers from outside the community – Languages and Physical Education – taught specialty areas.

School-wide systems ensured that consistency of approach was achieved: weekly leadership meetings and common goals, discipline areas were maintained despite multi-community teaching, and sharing of considerable numbers of staff across communities.

In 2013 the teaching profile at Tellurian SC constituted 63 teachers and 27 Education Support staff. The year 7 community being examined had 15 permanent teachers including one leading teacher. The leader was responsible for behaviour management and community functioning. Several teachers moved between communities and were less permanent members of the Year 7 community.

The second data collection occurred in December 2014. The second cycle occurred after the school decided to move away from single year level communities. The communities were arranged around all year levels combining years 7 through 10. The school determined that this would provide greater flexibility in program delivery and allowed for a higher level of social interactions between the year levels.

In 2014 the total student enrolment had dropped to 730. The selected community consisted of 162 students. The disciplines were arranged around paired classes aligned on the timetable and in space. This meant that Mathematics classes were always paired together. The same arrangement occurred with English. Of note was the pairing of Humanities and Science within each community. This allowed for integrated units across the two disciplines. The timetable, when considered across the entire school, aligned such that it allowed for larger groups of same year Humanities subjects to combine. This was a deliberate strategy at school level in order to maintain flexibility of combinations as it was reported as being an invite to innovation.

Tellurian SC was identified as providing a mathematics program that met the criterion of quality teaching and learning as outlined by the Literature. The site selection occurred as part of purpose sampling. Data collection focused on the participants of the mathematics program. Data were collected across two research cycles. The first cycle focused on a team of four teachers teaching the program. The second cycle provided the opportunity for a more detailed examination and focused on a team of two teachers with one teacher being consistent across both cycles. It also involved close observations of practice and an interview with students. The student interview was conducted to examine the extent to which the broader findings aligned with student perspectives.

The first cycle consisted of a single interview with four teachers, each possessing a range of teaching experience. This included various experiences at primary and secondary school level as well as a mixture of teaching experiences in open plan settings. The teachers formed a single team enacting the Scintilla mathematics program to four classes simultaneously. The interviewees included a leading teacher (24 Years), two accomplished teachers (8.5 and 5 years respectively) and a novice (3.5 years). In the year prior to the program being implemented a six month period of time-release was provided to one teacher to develop the program and conduct a trial. The time amounted to several lessons per week.

A more detailed data collection took place in the second cycle. As a result of organisational changes outlined above the same mathematics program was taught to two classes as distinct from four. The second round of interviews consisted of interviews with the two (teaching) team members as well as the program creator (though only participating in the first cycle team) as well as the Assistant Principal (curriculum). Moreover, four students participated in a group interview in the second cycle. This interview allowed for a brief examination of student experience for corroborative purposes. It facilitated an opportunity to identify similarities or differences between the teacher intentions and student experience. Formalised observations were conducted with a close tracking of practice in the program. Further interviews with the teaching team were carried out after the observations.

The physical make up of the school

The physical features of the site bear similarities to Alluvial SC. Particular features of the setting make it more open than Alluvial SC: un-walled staffrooms, less closed teaching spaces with transparent walls a feature of the one available single class space, soaring ceilings continued throughout entry and larger teaching spaces (as opposed to lower ceilings in such zones at Alluvial SC). The combined effect is to emphasise the scale of the buildings and marks them as distinct breaks from traditional school spaces.

The design features of Tellurian SC are based on the same principles as those underpinning Alluvial SC. The physical make-up is based on significant open plan learning spaces with a high degree of visibility. The spaces can accommodate up to four classes in a single session. Adjacent rooms provide for science lab specialties along with glass walled Socratic studios for classes of 25 students. The diagram below illustrates the principles of openness and staff accessibility. Shared facilities like toilets and kitchens can also be seen. The close proximity of daily activities for staff and students is visible in the design.

The learning communities across the school are similar in design. One variation occurs where the community is attached to the administration wing. That particular community varies only in its need to accommodate the entrance to the central staff facilities, library and canteen.

The overall school layout was intended to create clusters of communities with each building spilling into the central area. The scale of the site allows for ample space for a large number of students. The tendency has been for students to gravitate toward their home community during recreational times.



Figure 5 Tellurian Secondary College (whole school layout) [Used with permission]

The diagram below demonstrates the extent of openness achieved in the physical structure. An initial response involved positioning low profile locker banks in the centre of the open spaces. These acted as quasi-walls; part physical and figurative. The decision was taken after 6 months to push these lockers to the edges of the rooms and into less conspicuous positions.



Figure 6 Tellurian Secondary College (Year 7 community floor plan) [Used with permission]

An account of open plan practice: advance phase adaptation

A detailed rendering of the curriculum program at Tellurian SC reveals the community to be producing a sophisticated treatment of space and pedagogy underpinned by an understanding of learning grounded in social constructivism (Vygotsky, 1978) and premised on the needs of twenty-first century learners (Fullan & Langworthy, 2014; Rychen, 2003). This can be characterised as an advance phase use of the up-scaled spaces. Where Case Study 1 exposed the tensions and benefits of highly collaborative practice within the amplified settings of open plan, Case Study 2 provides an example of structure and practices attempting to manipulate the setting toward student-oriented, collaborative, ICT-rich learning. As such the emergent skills required of teachers can be identified.

Advance phase adaptation: maximising autonomy and differentiation

Scintilla mathematics at Year 7, 8 and 9 is designed to increase achievement through a program of personalised learning. Maximising student autonomy, establishing differentiation, and leveraging technology achieve this. Further, the program offers rich learning tasks designed to establish student understanding and skills across several platforms of application and expression.

The program involves up to four classes in a simultaneous multi-level enactment of mathematics. The tasks are characterised as rich in that they require students to create and apply: games, storytelling, puzzles, as well as non-fictional applications are used as assessments. Students undertake a diagnostic task that establishes their current ability and, once this is determined, continue seeking tasks in conjunction with the teacher.

Students complete an iteration of the task in accordance with their ability. The levels are created out of the AusVELS curriculum documents and can accommodate 7 levels ranging from grade 4 to year 11. Students are able sit anywhere in the space unless the teachers negotiate a specific arrangement (usually in response to unproductive behaviour).

Advance phase adaptation: establish ICT as a central feature

The tasks are presented with an initial video resource constituting the instruction of the particular skill or knowledge. These are authored by the team of teachers and vary in length and format depending on the task and technological competence of the teachers. Many of the tasks are annotated diagrams or filmed whiteboard instructions. All are striving to be brief and offer a support for direct teacher instruction.

This approach allows teachers to communicate the key message of the lesson quickly and allow those students ready to move on the chance to do so. Students wishing to seek further instruction or a greater degree of clarity can negotiate with the

teacher. This may be a smaller group with extra instruction or direction to a different task.

Students complete a blog that tracks their learning and establishes an evidence trail of work. Teachers use this to monitor student work and communicate achievements with parents.

Advance phase adaptation: close observation the enacted program

Close observation of the program in action saw a dynamic and complex learning environment consisting of multiple teachers enacting a program negotiated through existing resources and daily or lesson-by-lesson action plans. The broader schedule of the program was negotiated in conjunction with the Mathematics Department leader and team members.

The lessons observed across a week involved the teaching of 'landmark percentages' using mental arithmetic and extended through dual number line charts. Of particular note was the absence of each teacher, in turn, across the two double lessons. In each instance a fill-in teacher from another part of the school supported the regular teacher. The fill-in teachers were familiar with the school, the community model, and the Scintilla program. In each instance the fill-in teacher did not possess a mathematics qualification or background. Nevertheless, the familiarity with school and broad program allowed the lessons to proceed in the regular fashion.

Establishing themes

This case study was informed by the data collection carried out at Alluvial SC. Thematic categories established in Case Study 1 informed the questions and observations at Tellurian SC. Again, data collection and analysis was broadly categorised by teacher perception and reaction. First cycle coding methods were employed to determine initial codes. Subsequently, second cycle methods established analytical codes. Convergence and divergence between the studies was considered and will be presented after the third case study. Table 7 below presents the theoretical codes.

Table 8
Data analysis focus and theme (Tellurian Secondary College)

	Focused categories & literature reference	Final analytical coding
Teacher perceptions of the affordances of open space	Twenty-first century Learning (Fullan & Langworthy, 2014; Hattie, 2009)	Maximising possibilities: Flexibility
		Student & teacher autonomy
	Agency (A. Edwards, 2005; Giddens, 1984; Giddens & Pierson, 1998)	
	Non-traditional practice (Aitkin, 2011; Melhuish, 2011; Upitis, 2004)	Teaching and learning expectations
Teacher reaction to open space	Altered practice: scale & enactment (Boys, 2009; Deed & Lesko, 2015)	Administrative alignment: collective practice
		Necessity of space
	Shifting teacher knowledge (Billett, 2009a; Collinson, 1999; A. Hargreaves, 2013)	Adaptability & Letting go

Findings

The data revealed affordances as being constituted of flexibility, with a clear focus on "making the most" from the spaces. Student autonomy was perceived to be a change specific to the new open plan space. This had a consequence for levels of teacher autonomy. The data exposed a tension between existing understandings of teaching and learning and expectations prompted by the space and the program being implemented within it. The theme has been identified as "teaching and learning

expectations" but it is used here to categorise the broad spread of ideas encompassing existing understanding and emergent practices.

Themes of teacher reaction were understood as existing in the context of the altered practice found in the school curriculum response. In this way, alignment was identified as an analytical code. It constitutes alignment of curriculum and pedagogy with school wide resources such as timetable and staffing. Responses also revealed a shift in what is understood as appropriate teacher knowledge wrapped up in reaction to the open spaces. This is categorised as necessity of space and letting go.

Interesting responses emerged from teachers and administrative staff when considering factors enabling adaptation to practice. A sense of necessity for changed practice was clear at teacher and school level. The Scintilla mathematics program provided an example of quality teaching and learning requiring teacher adaptation reliant on administrative support. The alignment of resources in timetabling, staffing and development time proved essential to the success of the program.

Teacher perception: Affordances

Flexibility: Maximising possibilities

Flexibility was understood within a tight pedagogical framing. While the discussion of flexibility can be characterised as being positive, it was referenced against curriculum initiatives or student engagement. Teachers reported the space to influence the broad approach: "it has allowed us to deliver a curriculum to 100 kids and not 25… the buildings provided the opportunity" (Teacher M). Moreover, the spaces were understood to have potential and to be a part of the overall scenario.

> I feel like we're maximising the flexibility of this space… (by) having four separate classes operating in the large side. (Teacher L)

> There is a huge difference in how we negotiate spaces, matching resources to needs. This looks very different to past years. (Teacher M)

The flexibility is seen as providing access to a range of factors impacting curriculum enactment. The system response is afforded by the space and subsequently allows the manipulation of resources such as class grouping and deploying teacher expertise to match student need.

> Working to… strengths is mutually beneficial. Taking advantage too of people's strengths to work with different sets of kids is the way to do it. Strengths are deployed for the benefits of the students. (Teacher N)

Moreover, read as a feature of the combined design of curriculum program and space, the flexibility is understood to further benefit students.

> A positive is that the kids at the lower end of the scale are able to grasp the skills they need to instead of being sat in a classroom being taught to the middle and them not understanding. (Teacher M)

> With more than one teacher you can broaden the options for kids. (Teacher K)

The student experience revealed a sense that a greater range of resources was available. Students expressed an appreciation of the catering to different levels within the Scintilla program. Teachers were perceived to possess different skills and familiarity with the different levels. In this way students expressed a version of understanding the different sets of expertise, though they generally felt that all teachers should be familiar with all the levels.

> I find it hard when the teacher doesn't know about the task I'm on. One will know but the other one won't. It switches between teachers. (Student 2)

The experience of the lessons revealed the reality of flexibility to be made up of a vastly altered learning experience. Students were engaging with the material in small and large groups as well as individually. The students largely determined this with suggestions for productivity made by the teachers from time to time. The range of

activities undertaken to demonstrate learning varied. In one instance a student completed work that resembled straightforward bookwork (as in a worksheet) while a group of three students collaborated on a large-scale poster. Each instance of work resulted in the students finding an appropriate place to complete it. Students gathered in groups of three, nine and 12 (though the latter was made of two distinct groups and a teacher was generally nearby in order to ensure productivity).

Student + teacher autonomy

The space and system response was reported to alter student and teacher autonomy. The informants reported that student autonomy had increased while teacher autonomy had decreased or altered. The program of curriculum allowed greater freedoms for students and increased expectations of independence and self-directedness.

> Kids deciding where and how and from whom they want to learn. The open plan spaces allow that to happen. (Teacher Z)

> The positives are that the kids get to have their own choice in task. (Teacher M)

> Students are free to move between groups. Even if I'm in a low group I don't need to sit with the low kids. I have the flexibility to avoid streaming. (Teacher N)

The lived experience of implementing the Scintilla mathematics program demonstrated the high levels of agency for students and teachers. Students were free to negotiate on the tasks they completed and the form of assessment (though chosen from a given set of options). While many students chose to work at tables there were a large number who spread out across the space to use the floor, a spare whiteboard or a computer terminal. Others lingered at the "front" of the room near the whiteboard on ottomans and stools. Students were then to ensure they documented the work completed by taking photos and uploading the progress to their blog.

There was a clear sense in the student reflections that the space and the program provided opportunities for control of the learning experience. Students articulated a range of learning options including peer expertise, collaboration, teachers and the web resources.

> At the start of today's lesson I really didn't get it. Instead of hanging around out the front for more instructions I moved to some girls who knew it. They explained it then I got the teacher's help to check and see if I had it right. (Student 3)

The mode of engagement meant students were operating at different paces. The tempo of the lesson varied between groups and the groups themselves varied considerably in size. Group size did not appear to reflect the pace of the learning. This pacing allowed students to work in social groups as distinct from ability groups though observations revealed some students gravitating toward others of similar abilities. When questioned, they reported that they could help each other more easily this way. Other students communicated that sitting with a mixed group allowed them to share skills more easily.

Student interview reflections on grouping revealed a considerable mix of options with students choosing who to sit with based on what they perceived to be their needs. The students reported arrange of strategies for when they were being distracted by their table group. These included direct requests for 'quiet', putting music in and 'moving away'. Moving away was agreed as the most commonly occurring option.

The non-traditional program has impacted teacher autonomy. There is a high degree of compliance required for the program to function efficiently. Teachers are expected to work in teams and follow the program. The positive realisation of this is supportive teams and democratisation of expertise through modelling and public practice. The negatives are seen in lack of ability to follow a topic of interest and in the particular focus of the curriculum program.

Teacher autonomy was less evident in the heat of practice but the negotiation of roles prior to the lesson allowed individuals to align their expertise with the strategy they saw as best serving the lesson. In the case of the fill-in teachers, one was moderately confident with mathematics and negotiated more involvement with the actual task. The second fill-in expressed little confidence in the area and negotiated a role of roaming to ensure students were on task. The lesson revealed this teacher to be acting as something of a triage for student questions and on separate occasions assisted to direct students in groups where consistent inquiries were determined.

During regular instances the designated mathematics teachers negotiate in similar ways to ensure alignment of expertise and skills in line with program needs.

Student autonomy is also seen in community culture generally.

> …you have some kids who are starting to step up and ask other kids to do the right thing. (Teacher M)

> Kids who want to do well will draw themselves in a corner away from the space. They don't get distracted, they can work ahead. That's a serious advantage. They can keep the learning going at their pace. (Teacher K)

It was noted that there may be cohort or age-group specific responses to engaging with the community.

> Depending on the maturity level of the student the flexibility is either a really good thing or a really bad thing.

> At yr 10 they can manage themselves a lot better, they're able to work independently. (Teacher M)

Teaching and learning expectations

The tension emerging from the shifting realisation of autonomy is further amplified in the expectations of teaching and learning. The teachers at Tellurian SC articulated a break in the traditional expectations of teaching with the developing practice in the Scintilla mathematics program.

The dimensions of this tension include the centrality of the student, teacher authority and the knowledge specific to the discipline of mathematics. The program is understood as a "different model of teaching where you are encouraging a shift in authority" (Teacher L).

The following articulation of the program illustrates the shifting of control from teacher to student and the consequences for the role of teacher and the function of teaching:

> We want the interactions to be student driven rather than teacher driven. The student has identified their need and they reach out and grab the assistance they require. Rather than the teacher saying you need it because I've told you so… the student has made the decision as to what level of task they are going to do and how they are going to show they can do the task. Your assistance to them is therefore subservient to the choices they have made. (Teacher N)

Student reflections on expectations of learners revealed an understanding of the range of resources available to them as well as the need for initiative.

> The teacher might be busy and you can go ask your friend and they might help or explain it better. It boosts your confidence as well because you can work at your level and progress to the next level. (Student 4)

The observed lessons exposed the expectation of student control to be high. Students moved freely through the space and chose their own work groups. A description of various tasks has been provided. Together, these factors meant teachers

and students had to adapt to altered expectations of teaching and learning. A view of teaching that involves a static teacher with one or even two strategies for a predictable classroom scenario would be out of place in this setting.

An example can be seen in a snapshot of the space. Teachers could not rely on a quick examination of the space to determine whether students were engaged in learning. The extent of movement and chat through the room demanded that teachers maintained a reasonable connection with all students in order to determine how on task they were, or if they needed assistance.

The learning transactions between teachers and students were similarly altered. The range of tasks and achievement levels meant teachers could not offer a standard missive and expect to solve all (nor even a large proportion of) problems. Teachers worked with small groups, large groups, and individuals while assisting each with the relevant advice in order to progress or extend them.

Features of the program contributed to the tension. The combination of pre-recorded resources altered student perception of the role of teacher. The tendency was for students to seek out the teacher who authored the resource; the actual voice came to hold the authority.

> The kids might get confused about who their teacher is. I get confused kids trying to work that out. (Teacher L)

> In the year 8 class it is really clear who the boss is. That's usually the person who starts the class, who is standing at the front at the beginning of the lesson. (Teacher K)

The spread of resource creation to the rest of the team saw a shift in student reaction.

> As soon as they started to watch videos with my voice on it, suddenly all these students who I had not spoken to before were coming up to me for help. (Teacher L)

The program, further endowing the situation with tension, challenged the understanding of the discipline of mathematics. This challenge was true for teachers, students and parents. Some teachers were reported as being reluctant to commit to the system and eager to maintain control. Full support for the philosophy of the program was not yet achieved.

> Some teachers needed to change their practice before they changed their beliefs. (Teacher N)

Teacher reaction

Administrative alignment: Collective practice

Altered practice was acknowledged as occurring where the administrative impetus and structural supports were present. An initial alignment of the timetable was required to support the implementation of the Scintilla program.

> Once we started to change the timetable around we could bring classes together and teachers started to look around and think differently about how to use the space. (Teacher Z)

At the point of the first cycle of data collection the school had left the adoption of the Scintilla program at the discretion of the individual teacher. This meant that there were some teachers not using the program and others who were part of a team but participated out of necessity. It was perceived that this led to a lack of success.

> I think lack of success comes back to a different set of values about what good teaching and learning looks like. If you think the teacher sits up the front and does all the talking then you won't fit in the team… (Teacher N)

The second instance of data collection saw the Scintilla program installed as a mandatory program for Year 7, 8 and 9 Mathematics. This was achieved through alignment of resources based on the foundation of a timetable with high degrees of synchronised teaching and space use.

> (This) allowed teachers to expand their ideas on teaching and learning to use the space as it was first intended and designed for. It allowed for innovation. (Teacher Z)

Concessions had been made to install traditional elements of mathematics enactment at the behest of the broader team as well as vociferous students and parents.

> Thursday is skill and drill activities through Mathletics and the kids are sitting in the timetabled space with the teacher allocated on the timetable. They tend to stay in their timetabled room with the particular teacher. (Teacher L)

Parents, too, asserted some influence over this decision with considerable questioning of whether the work constituted that defined as 'maths'.

> The maths program is challenging for parents. We have many complaints or concerns. It's often the parents of high achievers. (Teacher L)

> That's often because their kids can coast with a textbook. They can easily sit and do problems and not think too much. (Teacher L)

The Scintilla program is also understood within the wider school context. Teachers acknowledge that Scintilla is unique in its design and demands of students. Any resistance – as a product of concern, motivation, or undeveloped skills – is perceived to be legitimised by the traditional mode of school offered in other disciplines.

> The problem is they are going from maths where they are being asked to be independent learners, make choices about their understanding, use technology appropriately to one size fits all, sit-down shut-up, write this in your book. Then the students ark up. (Teacher N)

The altered practice of Scintilla is exaggerated by the juxtaposition of the program against traditional models occurring in the school (at times with the same teachers).

A further concern arises when considering reporting mechanisms. The administrative responsibility of authenticating individual students' level of progress remains linked to individual teachers. Maintaining an understanding of all students on the list was reported as difficult within the Scintilla program.

> I don't have a lot of time to spend with just those kids and I worry my assessment is not going to be as accurate as it should be. I don't have the opportunity to sit down with them as I would with a smaller space. (Teacher M)

It was reported that the learning community can work to instil greater level of awareness generally.

> I am expected to know what is going on with my kids. It's important to how the community works. If I'm not on that it is more work for someone else. Likewise, I don't want to wear the burden of others. (Teacher K)

Necessity of space

The variation from traditional practice was further marked by the elements of the open spaces seen as impacting teachers and exaggerated given the context of the Scintilla Mathematics program. Scrutiny and deliberate space use were identified as central concerns.

The space and the curriculum program combined to amplify the scrutiny felt through high levels of visibility. This occurred at all times of the day: during teaching, informal interactions, non-scheduled periods of preparation, eating lunch, and during social interactions.

> The level of scrutiny here has been higher because teachers are concerned about the break from how we normally teach maths but you have to embrace it. You have to get over it. (Teacher N)

This made the act of changing practice even more challenging. There was a general level of reluctance to change amongst staff (not involved in Scintilla).

> We do have those staff who book the Socratic studio every lesson. Even though they are visible spaces they still do it the old way. They just don't want to be in the open spaces. (Teacher M)

Practice observations revealed full exposure of teaching in an obvious variation from traditionally arranged schools. Students were able to chat with the teacher toward the end of the recess break and the last five minutes of the break involved the teacher completing last minute preparations while chatting with a group of three students. The teacher answered questions about the forthcoming lesson, an assessment and the upcoming move to a nearby school. At the same time the teacher checked technical requirements and greeted other students to the space.

The production of the accompanying video resources has also provided greater levels of scrutiny. It was reported by one teacher to be the most acute expression of scrutiny. It is in the video production where students and teachers can linger over the minute detail of the content and the instructional integrity.

Engaging successfully with the space was reported as requiring understanding the potential of the space and the general shift toward student focused practice with a

fit-for-purpose approach. Across all interviews the space was reported as offering and allowing altered practice.

> The fact that it's open allows us to set it up. (Teacher H)

Observation of practice revealed that the program came with certain necessities. The learning environments became complex, charged, dynamic social settings with degrees of movement and, at times, noise that would generally not be accepted in a regular sized classroom. Teachers reported this as necessary; simply a part of it.

Adaptability & Letting go

> For a lot of teachers it is really hard to let go of the reigns. (Teacher L)

The case study at Tellurian SC also revealed a distinct awareness of the need to shift thinking on practice for the curriculum program to be successful. "Letting go" symbolised the shift from one understanding of teaching and learning to another. It represents elements of pedagogy, teacher authority, and teacher identity. The difference between a traditional classroom and the new program was noted as significant.

> Instead of sitting up there with a Powerpoint, which is the general practice – you give them the theory and a worksheet and do a prac on it. You can approach the concepts and the theory in completely different ways. (Teacher K)

> …our maths classes look different to the traditional model. Our kids have to write about their learning, tell stories, talk to other kids. (Teacher L)

The idea of "letting go" is present in the practice of embracing mistakes as opportunities to learn and, indeed, as a necessary part of the new understanding of

practice. Teacher identity as authority and knowledge-keeper is challenged under these circumstances.

> I know I do things wrong all the time, that's just part of it. (Teacher N)

This is further realised in the assessment strategy of the Scintilla program. Asking students to demonstrate their learning through narrative or images is challenging for some teachers. It was acknowledged that some teachers had yet to adjust certain aspects of their practice and understanding.

> There is a bit of work to do on teaching for understanding and good assessment. (Teacher N)

> The way we report on maths is milestones and that's usually a test. We need to figure out how we can assess them on the tasks themselves. (Teacher K)

Teacher identity is altered from the traditional model within this context. Delivering Scintilla in the open plan environments demands that teachers loosen the controls of a traditional classroom through responsive pedagogy and broad assessment. Teacher authority over such elements as student movement and lock-step progression is also challenged. Further, teacher as subservient to student needs requires a 'letting go' not required in other contexts.

> To me it's clear that you need to be able to be fluid. (Teacher N)

Fluidity captures the tone of the teacher operations during the Scintilla classes observed as part of the study. Teachers moved between collective instruction and small group discussion as quickly as they could turn 180 degrees. They were required to understand the rich tasks and have knowledge of student progress in order to support or challenge them through the next moment of learning. They were variously shepherds of large groups and provocateurs in small groups.

Concluding comments

Tellurian SC presents practice of teachers engaged with quality teaching and learning in an open plan setting. The Scintilla mathematics program is an advanced-phase response to the affordances of the novel school space. It rests on foundations of student-oriented pedagogy and customises the experience through comprehensive differentiation of tasks and assessment. Further, it is supported by administrative factors designed to enhance the scale and positioning of students within the space.

Case Study 2 is characterised as advance phase due to the mode of engaging with the space through program design and implementation. The study of Tellurian SC focuses on an instance of curriculum that has moved beyond a 'reaction' to the space; it is deliberately manipulating elements to augment teaching and learning. The elements in place such as timetable and space alignment allowed the mathematics teachers to use scale and teacher expertise to design and enact the program. The elements are used to serve the vision of teaching and learning as distinct from the program being a response to the existing structures.

A clear challenge was identified in student and colleague attitude. The ongoing practice of traditional methods outside the program and within later years of mathematics resulted in pressure on teacher and student participants. The altered spaces also presented challenges to teacher expectations of teaching and learning that exposed an intricate weaving of practice and beliefs as they to and fro'd in the adaptation of the ongoing daily life of school.

Teacher and teacher-student interactions were reported as occurring more frequently and impacting ideas of authority and collegiality. Further, the Scintilla mathematics program required higher levels of collaboration and agile practice focused squarely on pedagogy. The program amplified moments of consultation, diagnosis and progress and teachers had to respond to these critical junctures often and with acumen in pedagogy and discipline knowledge.

An instance differentiating early and advance phase can be seen in the response to visibility. Where at Alluvial SC visibility was reported as a loss in the shift to open plan, Tellurian SC informants discussed visibility in terms of its service to the program. There were reported moments of lost private time but the respondents generally understood it as necessary. Likewise, the shift to team-oriented practice was seen as necessary to the success of the teaching and learning philosophy.

The advanced-phase adaptation of Tellurian SC appears to have impacted teacher practice resulting in responses that are focused on the enactment of the program and anchored to the philosophical approach. In this way they are responses emerging from an instance of quality teaching and learning. The observations of practice reveal a clear break from traditional practice and high demands of teachers in their understanding of education and skills of practice. Theoretical codes have been established informed by Case Study 1 while fealty to the data was achieved through first cycle focused coding.

The second case study allowed for a detailed and focused examination of a specific instance of quality teaching and learning. This allowed for the exploration of a particular moment of practice providing accounts of teacher practices significantly varied from the traditional model. The emergence of convergent or divergent analytic codes will be conducted in the cross case analysis as part of the discussion.

Case Study 3: Matassa Secondary College

Matassa Secondary College (SC) was chosen for several reasons. First, the case study sites already canvassed form a combined system with the senior campus. The relevance of a senior response to the initiatives in the junior campuses is critical to the success of the BEP goals. Secondly, the adoption of open plan teaching spaces and a tightly aligned curriculum response is unique in senior settings. The dominant shape of teaching spaces in the school resembles the industrial model of single class spaces. The school sought to harness the physical structures to inspire a rejuvenation of teaching and learning. Moreover, identifying emergent skill sets requires the tracking of practice across multiple relevant settings.

Contextual features

The adoption of the open plan spaces is interesting for its position in the timeline of the BEP. The planning and implementation of the senior school open plan settings occurred after all 7-10 schools in the BEP had commenced practice in the spaces. In this way, the design of the buildings and curriculum structures were able to draw on early adaptations of the four BEP participant schools. Hence time and remove from the early phase occupation of the spaces and adaptations of curriculum programs were recognised as advantages by the school leadership in devising a response.

The school provides the Victorian Certificate of Education (VCE) and the Victorian Certificate of Applied Learning (VCAL) as well as a large number of Vocational Education and Training (VET) certificates. The student population totals 1756. Subject provision occurs in Units with four semesters across two years dividing the subjects. This generally means that students are split into years and single subjects.

English remains a compulsory part of the VCE and VCAL meaning all students at the school are required to enrol in an English or literacy subject. This case study focuses on the provision of the mainstream English subject at Unit 2 level (designed as the penultimate year of the senior qualification) though the informants draw on experiences involving a range of English subjects and senior certificates.

The student profile at Matassa SC is made up of students from all four 7 – 10 campuses across the town. A further 10 per cent of the total is drawn from beyond these schools. This means that the socio-economic profile is broadly the same. There is, however, a difference in SFO density due to attrition through school leavers. The SFO density at Matassa SC was 0.45. This represents a slight lift in the SFO density in relation to three of the campuses but is similar to a fourth. Again, all quartiles of the socio-economic measure are represented in the student cohort.

The staff profile is 116 effective fulltime teaching positions with some variation in the final number of actual teachers due to part time staffing arrangements. Education Support staff totalled 49. The English faculty constitutes 24 staff with the case study

community housing 14 in the central staffroom. One leading teacher is also based in the community staffroom and is responsible for curriculum accountability, teacher allocation and resource management. The spread of expertise in the English staff means that many teachers cover the various English subjects – English, Literature, English Language, Literacy and Foundation English – as well as teach across faculties such as Humanities and VCAL.

Broader forces also impact the senior setting contributing to the preservation of traditional ideas related to space and curriculum design. The senior setting regularly features outcomes-based or qualification driven approaches (ACARA (Australian Curriculum Assessment Reporting Authority), 2013a; Victorian Curriculum Assessment Authority, 2015). Despite a widespread debate on the merits of such an approach the traditional mode prevails across Western education systems (Allais, 2006; Kirst, 2000). The addition of university selection processes to Australian senior certificates contributes to the social expectations tied to education that results in 'academic' subjects preferred in student selection and resource allocation (Teese & Polesel, 2003).

Outline of data: collection and participants

Data were collected through a single interview with two English teachers. The pairing was chosen as a select sample from which to commence exploration of the senior setting. Each teacher taught using the space but in separate aligned teams. The first teacher had 25 years of teaching experience including all levels of secondary across numerous school sites. The second had 5 years experience limited to the case study setting. Each teacher also had experience teaching into Humanities subjects where the traditional mode of single subject classes remains the norm.

Matassa SC provided an opportunity to explore the themes emerging from the first two sites. Informed by the earlier case studies, broad themes of perception and reaction were adopted. Interview questions asked teachers to reflect on ideas of flexibility, scrutiny, and collective practice. In particular, questions sought to compare

experiences of the new English community space with that of the single class arrangement.

The physical make up of the school

The English community facility is a significant break from the rest of the school. The senior setting has generally followed a traditional layout recognisable as industrial with buildings spanning across the nineteenth and twentieth centuries. The ideological inheritance is traceable through the physical structures; one wing still contains raised teacher platforms; another, corridors and single staff offices. While the school has made significant progress in modernising facilities and practice – the art wing includes a degree of openness with a large breakout space doubling as exhibition space – the single classroom remains dominant.

The schematic (figure 7 below) of the English community illustrates the degree of the openness and emphasis on flexibility. The design straddles the traditional heritage of the senior setting as well as offering prompts toward innovation.

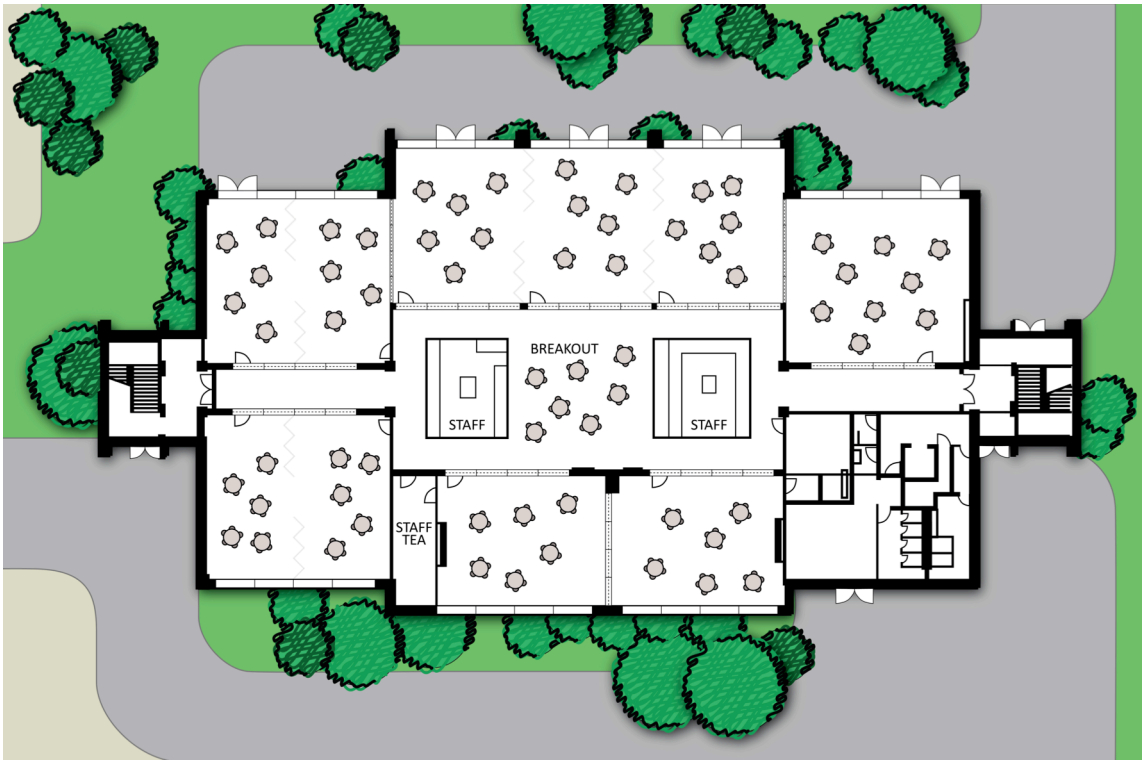


Figure 7 Matassa Secondary College English community floor plan [Used with permission]

Openness is achieved through retractable floor to ceiling glass walls between classrooms that can be opened to varying degrees. The internal walls – facing an internal breakout area – also feature large windows with visible scrutiny a dominant factor in interview data. The English building also contains an oversized single space classroom that accommodates two or three classes scheduled at the same time. All bar one classroom provides access to external breakout zones. Natural light is maximised through large windows to the outside and a double-story light well in the internal courtyard. The central staffrooms flank the internal courtyard maintaining high degrees of visibility to the classes and breakout zone.



Figure 8 Matassa Secondary College English community (internal detail) [Used with permission]

An account of open plan practice: mid to advance phase adaptations

A detailed account of the curriculum response reveals considerable difference to both Alluvial SC and Tellurian SC. The systemic response saw a strategic and tight alignment of resources and enactment. The English department leadership designed Year Eleven English into a synchronised whole. The timetable and physical spaces were aligned with up to four classes being taught at the same time in adjacent spaces. The synchronisation also involved the curriculum program being centrally controlled through weekly schedules, common assessment tasks and calendar. In this way teachers work in clearly defined, highly visible synchronised teams with common meeting times as well as a program of blind peer marking.

Mid to advance phase adaptation: shifting between tradition and innovation

Of note is the continued focus on established pedagogies commonly found in the senior setting. While a broadly student-oriented approach is preferred the use of direct instruction remains a part of the VCE teaching and learning experience. Further, the assessment schedule and type was a response to the preparation of students for the final year of English. The external assessment and moderation through exams in Units three and four meant a reasonable amount of attention was given to this strategy as part of the English curriculum in Unit Two.

Mid to advance phase adaptation: curriculum overlay

This case study is characterised as a mid to advance phase adaptation to the open plan setting. The presence of a significant administrative overlay – borne of necessity of setting and innovation – is evident. However, the optional features of the program in the form of operable walls, teacher negotiated collaboration, and embedded elements of typical and traditional assessment and pedagogy mean that the program is yet to reach the advanced stage of Tellurian SC. The structures of the program mean that it is capable of achieving this but the implementation allows for practice that is characterised as shifting between mid and advance range adaptation.

Establishing themes

Data collection and analysis was categorised using teacher perception and reaction to the up-scaled open plan setting. The analytic codes of Case Study 1 were used to frame the research at Matassa SC. Initial thematic codes were established from the data and referenced against the literature. These gave rise to the analytical codes. Divergence and convergence between the three case studies was considered and is presented as part of the Discussion chapter. Table 8 charts the first and second cycle coding of the data.

Table 9

Data analysis focus and theme (Matassa Secondary College)

	Focused categories & literature references	Final analytical coding
Teacher perceptions of irregular spaces	Irregularity and flexibility (Boys, 2011a; Gulson & Symes, 2007; Horwitz, 1979)	Flexibility of space
		Increased visibility and scrutiny
	Disruption to traditional space-time conditions (McGregor, 2004; Melhuish, 2011; Usher, 2002)	Freedom and altered obligations
Teacher reaction to irregular space	Navigating tradition and innovation (Cooper, 1981; Desforges, 1995; Wallace, 1980; Woolner et al., 2007)	Team orientation
		Negotiation and adaptability
	Affordances of the senior secondary context (Billett, 2009a; Hoekstra & Korthagen, 2011; McGregor, 2003a, 2004c; Otteson, 2007; Teese & Polesel, 2003; Wilson & Demetriou, 2007)	'Acting differently' and 'going on'

Findings

The data revealed the repeated themes of flexibility and scrutiny. A variation occurred in the expression of altered obligations of the professional role encompassing pedagogical practice and relating to colleagues. Teacher reaction was coded as team orientation, negotiation and adaptation as well as acting differently and going on.

Teacher Perceptions: affordances

Flexibility

The open space was understood by both teachers to be a gain. Flexibility was seen as a central element in establishing this gain. Of note is the observation that the

form was understood to dictate the use of the space. The space demanded flexibility and was described as encouraging particular practice. Retractable clear doors were understood to invite practices such as team teaching.

> Having this open plan area where you can open the doors on the day if you wanted made that really feasible. (Teacher Y)

Visibility and scrutiny

Visibility was also considered to be a positive contribution. While such visibility led to increased scrutiny, adding pressure in the initial stages, it remained a positive. Visibility was associated with accountability. This was considered to be "a good thing", providing opportunities for extension.

Another layer of accountability was achieved through the synchronisation of the curriculum program. The explicit requirements of timing and content worked in concert with the high visibility to achieve accountability. It is worth noting here that such scrutiny was understood to have created pressure for some teachers. The levels of scrutiny were seen as empowering by the informants, but they were aware of negative responses to the conditions.

A particular phenomenon noted was the potential for teacher isolation in the community. Teacher P explained that some colleagues found viewing other staff intimidating as opposed to empowering. Moreover, it was possible to "stop seeing through the walls" (Teacher P).

Freedom and altered obligations

There was a particular view of freedom expressed in the interviews. Freedom involved the ability to engage in a variety of pedagogies. This created a fluidity of practice in arrangements with a focus on collaboration. Program alignment was seen to facilitate increased ability to respond to requirements in unique ways.

> It tends to happen in that kind of spark way. People looking at the timeline together decide they could do something together. (Teacher P)

The community space gave rise to increased collaboration in practice and in conceptualising differentiated classes. Further, high visibility meant that borrowing emerged as particular phenomenon. Teachers would see an activity or set of notes through the glass and negotiate to borrow them or use them immediately.

> The space itself – though it didn't dictate that I borrow from them – enabled it in a way that wouldn't have occurred without it. (Teacher Y)

Altered obligations arose from the tangible freedoms experienced from day to day. The flexibility was expressed as impacting on a sense of obligation toward colleagues with a focus on trust and respect. An expectation of self-confidence and adventurousness was reported as an altered obligation.

> Willingness to try different things because many of the teachers who work here are quite experienced and have spent most of their career working independently. (Teacher P)

The autonomy established by singular accountability to student results, strict assessment programs and external exam moderation is challenged by the emergent collective practice and collaboration leading to adaptability.

Teacher Reaction

Team orientation

Team orientation is an outlook and tendency coupled to increasing interdependence. Team orientation has emerged in response to increased collaboration, necessary resource sharing and visible practice. It is perceived as a necessary element of open plan learning spaces and is understood through altered practice.

> Because of the glass walls between classes and lots of windows into classes there's a sense of the English team that is together. Also a sense that the work being done in the English team is on show. (Teacher Y)

As well as providing a tangible home for the English staff, the learning community allowed the development of an identity located in space. This is in contrast to the previous model that saw classes and staff dispersed across the school.

> There is a much stronger sense of the English team as a whole.
> (Teacher Y)

> …there are two other people working at the same time as you with kids who are probably thinking the same thing, at least you can support each other if you work together. (Teacher P)

A set of professional obligations has emerged as a part of the team practice in the open plan learning space. Respect and trust were reported as being significant obligations: respect for practice other than your own and deference when required. There is also a sense that risk taking is also valued. That challenging one's own practice is part of the deal:

> To do things that you see other teachers doing that appear to be working well and having the guts to experiment with different teaching styles. (Teacher y)

Adaptability

The synchronous program has seen a marked increase in shared practice. The space is perceived as having impacted on frequency of interactions and the need for negotiations. Team interactions are understood to occur differently.

> It *[team]* becomes much more of a day to day thing rather than big picture (choosing a text, deciding on time frames). We see each of us teaching or we teach together. (Teacher P)

Team based practice occurs across all phases of the teaching experience; planning, implementation and assessment all feature team members. The increase in negotiations requires a greater degree of adaptability.

A further pressure is experienced in the visibility of negotiations. Adaptability becomes essential where teachers must be flexible, responsive, respectful and trusting. Open staffrooms and open classrooms giving rise to the public and regular occurrence of negotiations heighten the demands on teachers. Adaptability is critical to success under such conditions.

> The actual experience of doing it was that it was quite fluid. If a problem arose you were able to deal with them. (Teacher Y)
> When we're observing things together we can negotiate to do something in response. (Teacher P)

The nature of the highly collaborative environment has given rise to particular concerns. A suppression of self was identified as a risk in collective practice, though the general feeling was one of positivity.

> In certain pairings of teachers you have to suppress certain aspects of your teaching style in order to accommodate for the teaching style of the other person. (Teacher Y)

The necessary adaptability here leads to a challenge of professional identity. This was more evident in the early stages of the new space. There was a sense that teachers had to play a particular role. A more negotiated system has developed as practice has extended across time. Teams will opt to teach together to suit their ends as distinct from permanent team teaching. This has relieved pressure and also demands further

skills of adaptability. The increase in negotiations is simultaneously the product of the open space and the solution to negative consequences.

'Acting differently' and 'going on'

The synchronous curriculum program has allowed the possibility of different realisations of senior curriculum implementation. The differences required within these circumstances are coupled with the ongoing pressures associated with the senior setting: formal assessment, external modification of results, and exams. The tightly aligned program is itself a form of acting differently: an adaptation that still accommodates existing necessities and traditions. Unlike the generally conservative practice emerging from the boundaries of verified assessments and external monitoring, the open plan learning environment has created a scenario where risk and failure are embraced; where acting differently and going on occur simultaneously.

> Being prepared to accept that we won't be perfect all the time. That we'll try things that may not work. (Teacher P)

> The willingness to try different pedagogical approaches. (Teacher Y)

Acting differently is seen in the need to explain teaching strategies to students. The greater range of teaching strategies and the increase in teachers negotiating in the learning spaces has meant teachers need to be accountable for their pedagogic approach. The regular mechanisms of power and control of pedagogy are challenged by the practices within the English learning community.

> We made it clear as to why we were both there other than it was a mixture of both of our classes. They saw there was a pedagogical purpose to us being there. I think making that explicit is really important. (Teacher Y)

The instances of acting differently clearly impact the students where traditional iterations of teaching are occurring in most other classes. This interruption warrants justification. Explaining the approach to the students must necessarily address the

adherence to the requirements of assessment and external monitoring. In this way, teachers are in the process of going on and acting differently.

Concluding comments

The third case study presents a further variation of practice within an open plan setting attempting to achieve quality teaching and learning. The English program at the senior school is characterised as straddling mid and advance phase response to the affordances of the altered setting. The highly aligned program allows for innovative practices such as targeted team teaching. A broad sense of collective practice is emerging. While the program has its foundation in student-oriented flexible practice, a low degree of customisation and sporadic use of technology – mostly the result of the pressures of the senior setting – leave it short of the heightened twenty-first century learning experience.

The study of Matassa SC focuses on the practice of two teachers as they engage with the altered English program taking place in the open teaching space. As distinct from Tellurian SC, the English program established non-compulsory administrative invites for the sort of practices the leaders saw as constituting quality teaching and learning. The optional engagement as a feature of the program was deemed necessary in the setting and sees it sit as a generally mid phase response with moments of advance phase practice occurring.

Where this is occurring success appears to rely on a combination of innovation and tradition. The existing pressures of external assessment and validation through exams must be balanced with the affordances of the space and impetus to accommodate for twenty-first century learning. The program through synchronised and aligned teaching further enhances the affordances. Practice in these instances relied on high degrees of collaboration and a collective outlook. The informants reported some impact on teacher-student relations but the greatest impact was reported as occurring in teacher interactions.

The English program amplified teacher-to-teacher consultation and encouraged joint planning and practice without dictating the need or shape of implementation. In this way a 'fit-for-purpose' strategy emerged from the affordances of space and program alignment.

Case Study 3 provided insights on the interplay between beliefs and practice. Where the program suggested practice there was a reported variation in rate of engagement amongst the informants' colleagues. Further, the clear glass walls meant practice was shared incidentally resulting in the spread of strategies and the take-up of joint practice.

Matassa SC provided this study with a further example of practice within an open plan learning environment. The high degree of alignment provided an example of a structural overlay in response to the affordances as well as specific examples of practice within these confines. The voluntary engagement meant a further insight within the data showed teacher understanding of potential practices was enhanced by exposure to examples and ease of application (achieved through alignment).

Of note was the perceived challenge related to high degrees of visibility. The glass walls were understood to be positive mechanisms for incidental sharing and encouraging collective practice; however, they were also identified as creating isolation. This counter-intuitive observation was reported as resulting from the increased pressure upon seeing peers in action. The impact of visibility for some was intimidation not support.

The English program at Matassa SC is a clear variation of traditional practice. Further, it is a break from the practice that dominates the rest of the school and, at the same time, of other areas of English curriculum in the same space. The instances of joint practice enabled by the aligned program and synchronised space revealed particular variations of teacher practice that attempted to balance existing needs with innovation.

Analytic codes have been established from the data by following a first and second cycle coding approach. A cross case analysis will identify convergent or divergent analytic codes.

Chapter 6 Discussion: Multi-case study analysis

Introduction and orientation against the research question

The discussion herein is a multi-case analysis constructed around the three case studies presented in the previous chapter. The analysis allows for the identification of cross-case similarities and differences referenced against the literature. The central research question frames the analysis:

> What are the sustainable or generative teacher skill sets in teaching and learning within open plan learning environments?

Further, the following questions inform the central question:

- What are enablers and constraints contributing to teaching and learning in open plan settings?
- What conceptions of collaboration (and leadership) in traditional settings contribute to our understanding of collaboration and leadership in open plan settings?
- What constitutes expertise for teachers in the open plan settings?
- What are the theoretical and practical implications of these findings?

A further set of considerations arising from the graduated stages of development in open plan settings frame the discussion of the research question. Identification of the system overlay, captured here as the site-specific curriculum response and conceptualised as *embedded affordances*, are situated in the graduated scale and informs the multi-case discussion. In this way, the distinct cases can be assessed for similarities and differences.

This chapter also examines the research questions using the identified analytic codes or themes arising from the data. Further, the themes inform the discussion and provide a frame for convergence with or divergence from the literature.

The findings of the data are also considered against the theoretical constructs structuration and relational agency. The use of affordances as a sensitizing lens is also considered for adequacy and suitability.

This chapter also provides a metaphorical representation of teacher response and practice specific to the affordances and lived experience of the up-scaled open plan learning environments. The existing architectural metaphors of openness and flexibility, in particular, are reimagined and extended. Similarly, figurative expressions of teacher practice and identity are examined and extended in light of the research findings.

Collated findings by focused categories and final analytical coding

The following section presents similarities and differences from the three case studies. The focused categories stemming from the literature have informed and been shaped by the field-based research (Charmaz, 2006; Yin, 2006). Data analysis saw further interplay between the literature and data collection resulting in the final analytical coding.

Data collection and analysis was shaped around teacher perception and teacher reaction within the open plan context. The case studies presented similarities and differences. The data revealed considerable similarities reaching across all three sites. The differences across sites are understood as *divergence within a theme* as distinct from significant or stark. An initial presentation of the cross case similarities and divergences is followed by a cross case analysis informed by the graduated phases of development occurring across the three sites.

Teacher perception of the affordances of open plan learning spaces (collated)

Similarities of teacher perceptions were revealed in the understanding of affordances of the open plan spaces. The focused categories and final analytical coding uniting the three sites are presented in the table below:

Table 10

Collated data analysis focus and theme: Teacher perceptions

Collated Case Study findings	**Focused categories**	**Final analytical coding**
Teacher perceptions of the affordances of open space	Openness and Flexibility (Boys, 2011a; Gulson & Symes, 2007)	Flexibility
	Agency (Giddens, 1984, 1991)(Giddens, A. Edwards)	Visibility and scrutiny (Student and teacher autonomy)
	Rethinking conventional organisation of space and time (Melhuish, 2011; Upitis, 2004; Usher, 2002)	Altered role of teacher
	Non-traditional/twenty-first century practice (Fullan & Langworthy, 2014; McGregor, 2004b; Oblinger & Oblinger, 2005)	Teaching and learning expectations

Flexibility

The dominant theme amongst the data was flexibility. The open plan spaces were understood to offer a greater range of practice options and were generally seen as enabling. Concepts of irregularity and flexibility (Boddington & Boys, 2011; Boys, 2009; Gulson & Symes, 2007) present in the literature take on a practical realisation in the occupied open plan settings. The intended disruption to regular traditions of organising space and time (Department of Education and Early Childhood Development, 2008; Dudek, 2000; Nair et al., 2009; Oblinger, 2006) were observed as ongoing features of the lived experience of open plan spaces. Flexibility was used across all three sites to characterise potential and existing practice, thinking specific to pedagogy, and the general approach to education. It was used to represent the challenge to traditional methods and the possibility of building new pedagogy. The inevitability of a shift toward

twenty-first century learning described by Fullan and Langworthy (2014) was seen as part of the open plan experience though this appeared to occur in pockets where adaptation was well progressed and embraced by teachers.

The use of flexibility as a term by teachers suggested an understanding of the potential for change, though it did not carry meaning for educators beyond the general. Where ideas of flexibility were given further context through an explicitly expressed idea of teaching and learning the scope for practices reflecting twenty-first century learning was enhanced. For instance, the teaching and learning philosophy focused on personalised learning at Tellurian SC provided the Scintilla program with a foundation stone. The same scenario is found at Matassa SC. Flexibility may be seen as necessary but it is not sufficient in achieving twenty-first century teaching and learning.

High visibility and scrutiny

High visibility and scrutiny were reported at all three case study sites. The impact of high visibility as a design feature is loosely represented in the literature. Visibility is an intended feature of open plan designs (eg: Nair et al., 2009) though there is little exploration of the consequences (Blackmore et al., 2011). Post-occupancy evaluations do not account for the lived experience (Higgins et al., 2005) leaving the intensified scrutiny experienced as a result of the open, highly visible and constant accessibility of the spaces an unmapped corner of the corpus. This study provides insights on the consequences of high visibility in open plan settings based on detailed account of the lived experience. In this way the study represents an expansion of the previous empirical studies.

High visibility leads to heightened levels of accessibility and scrutiny. Heightened accessibility and increased scrutiny were recognised as a distinct break from traditionally arranged practice in the data from all three sites and is reflected in the literature contrasting isolated practice with innovation (Cochran-Smith & Lytle, 1999; Hatton, 1985; Lortie, 1969). Expressed as changes to authority and hierarchy, teachers reported greater ownership of the space and willingness to make decisions once left to those occupying formal leadership positions, “Don’t need to go to the leader/co-

ordinator. If you do that you are just wasting time. Go straight to whoevers got the class and say what you need. You don't over complicate things" (Teacher B). "There's no qualms about someone going into someone else's space and having a chat to kids or settling them down" (Teacher A).

Negative consequences of the heightened scrutiny are also evident. The nature of the open plan environment meant teachers were seldom 'off duty'. The constant interactions and a need to maintain a presence at all times led teachers to be aware of the charged power relations as part of the space (Foucault, 1979/1975; Markus, 1993).

There was also a risk of visible isolation. Teachers reported the early stages of using the open spaces as intimidating and uncertain. This usually gave way to a level of comfort, though the normalisation of the practice was achieved at varying rates. In the case of visible isolation the teacher interprets the high visibility as intimidating with little progress toward normalisation of the situation. The risk is that the teacher's isolation is on show (at least to her). The result of the increased scrutiny was a reported shift in the sense of agency for teachers and students. The positive and negative impacts are acknowledged.

Agency

Conceptualisations of agency provide a lead in understanding the emerging practices of teachers in open plan settings. Agency within open plan settings is recognised as complex and multi-faceted (Deed, 2015b). Where high visibility has led to increased scrutiny through shifting ideas and realisations of authority and hierarchy, relational agency (A. Edwards, 2005) offers a reference for understanding teacher-teacher and teacher-student relations. A. Edwards (2011) conceives of relational agency as joint work in the heat of action, both mediated by common knowledge and building common knowledge. This occurs between teachers, and teachers and students, as they engage in pedagogy focused on shared purpose. The realisation of shared purpose through innovative and agentic pedagogy was observed in the data, though again this was most evident in the instances of practice reflecting twenty-first century teaching and learning.

The intensity and amplification of practice through increased scrutiny and ongoing, critical collaboration has changed the character of agency in schools. Single-teacher in private practice is no longer the norm. Relational agency provides a frame for an initial reference; however, a closer examination within the open plan context is identified as necessary for understanding the implications of the practice. An account will be provided once collaborative practices have been considered further.

A further perception of the setting is identified as the altered role of the teacher. This is closely linked with the teaching and learning expectations. The data at each case study site revealed similar responses: the spaces offered opportunities to reimagine practice and required a shift of existing or traditional ideas of what teaching and learning could be. “The kids are driving the role of the teacher, the teachers aren’t dictating terms” (Teacher N). There were also some instances of teachers finding alignment between existing ideas about teaching and learning and the possibilities afforded by the open plan setting, “the context in which I now find myself, calls for a model of teaching that, to me, feels quite comfortable. This method of learning for my students also aligns with my philosophy and beliefs” (Teacher L).

The analytic codes of *altered role of teacher* and *teaching and learning expectations* are interlinked by theme but separated here to distinguish between perceptions of (potential and realised) practice and shifts or confirmations in underlying understandings. In this way the perceptions can be read as a disruption to both practice and theoretical understandings. This brings the literature on learning spaces and teacher knowledge together.

Teacher knowledge

Teacher knowledge is accepted as both theoretical and practical (Adoniou, 2014; Cochran-Smith & Lytle, 1999; Desforges, 1995). Knowledge *of* and *for* teaching is understood as being interrelated (Cochran-Smith & Lytle, 1999; Elbaz, 1981). The relationship between belief and practice is understood as recursive. At various times, each precedes the other. The data revealed a similar asynchronous development of

practice and knowledge. The perceptions of the role of the teacher and beliefs about teaching and learning expectations varied within teacher teams and was reported as occurring as a saw-tooth progression for individuals. This is in line with the understanding that theory and practice must inform the other and that this does not occur in an orderly progression. The novel settings, along with the staccato and saw-tooth shift in teacher understandings and practice communicated in the data, provide further impetus to the existing momentum toward an understanding of teacher expertise as relational and adaptive (A. Edwards, 2010, 2011) based on a foundation of collaboration (Collinson, 1999; Rogers, 2002). Subsequently, implications for teacher training and development must be considered.

The literature calling on a rethinking of the organisation of space and time within schools (Aitkin, 2011; McGregor, 2004b; Upitis, 2004) as a catalyst for affecting twenty-first century learning experiences (Dede, 2005; Fullan & Langworthy, 2014) is largely theoretical with minimal contextualised findings (Cleveland & Fisher, 2013). The impact on teaching and learning has not received a detailed mapping in the literature. Leads on critical locations and potential practices in open spaces are emerging (Deed, 2015a) though a broad adoption of a recognised model for analysing the spaces is not present (Gislason, 2010, 2011). This study identifies the key enabling constructs of open plan spaces based on a detailed account of the phenomenological experience of practice geared toward twenty-first century learning.

Teacher reaction to open plan learning spaces (collated)

Teacher reaction to the open plan learning setting revealed considerable similarities. The focused categories and final analytical coding uniting the three sites are presented in the table below:

Table 11

Collated data analysis focus and theme: Teacher reactions

Collated Case Study findings	Focused categories	Final analytical coding
Teacher reaction to open plan space	Constraints of routine and pedagogy (Cooper, 1981; Desforges, 1995; Gislason, 2009; Woolner et al., 2012)	Collective practice
	Professional cultures of teachers & Relational agency (A. Edwards, 2005; D. Hargreaves, 1980; Hatton, 1985; Prain et al., 2013)	Team orientation
		Necessity of space
	Navigating tradition and innovation (Cooper, 1981; Desforges, 1995; Wallace, 1980; Woolner et al., 2007)	Adaptability
	Affordances of context (Billett, 2009a; Hoekstra & Korthagen, 2011; Otteson, 2007; Wilson & Demetriou, 2007)	

The data specific to teacher reaction to open plan spaces revealed considerable links between perceived affordances and teacher action; however, the presentation of collated themes united by common analytical codes is not intended to suggest causality between the identified themes. The complex nature of the settings and the uneven take-up of the various offerings of the spaces require an intricate and nuanced reading.

Collective practice

Collective practice was reported and observed across all three sites. The administrative alignment of teams was an explicit goal of the BEP and is driven by the

established claims of team-based practice leading to improved outcomes through diverse pedagogy and higher levels of accountability (Borko, 2004; Engestrom, 2008; Gislason, 2009; Rogers, 2002; Shulman & Shulman, 2004; Slater, 2010). A parallel with literature on collaboration is evident (Adler & Heckscher, 2006; Engestrom, 2008; A. Hargreaves, 1991; Johnson, 2003). The central belief that increased scale equates to broader teaching and learning options pervades the thinking of administrators and school leaders at various levels of governance (Department of Education and Early Childhood Development, 2008; Department of Education and Training, 2003; OECD, 2011). Interview data demonstrated a general acceptance of the value of teachers working in teams though the particular shape of this varied between sites. At one school the community-based team was described as a family or community with a clear sense of ownership and belonging. At another school the articulation took on a more pedagogical tone with the various programs clearly in the service of a vision of teaching and learning. The views of informants appeared linked to beliefs about learning and related to the curriculum program specific to the site.

Increased instances of collective practice gave rise to an observed and reported change in professional orientation in all three schools. Team-orientation contrasts with the singular or private practice heritage of teacher culture (D. Hargreaves, 1980) and is in line with patterns of desirable cultures of teacher development (Cochran-Smith & Lytle, 1999). Teachers reported placing the team ahead of individual needs. All schools reported an understanding of the advantages as a more efficient distribution of teacher expertise. The inherent tension in collaborative practice was present in the data and is represented in the literature as an interplay between the autonomy of individuals and the needs of the collective (Fullan, 1993b; A. Hargreaves, 1994).

Collective practice in an intensified setting

The character of collaboration is altered by virtue of the intensity and nature of working in the setting. The combination of high levels of scrutiny, ongoing low-level interactions, necessary professional alignment of teams producing intensified and critical moments of joint-practice, as well as an understanding of practice as inherently

flexible and team oriented, sees the amplification of collaboration. The literature focused on concepts or strategies such as co-teaching or team teaching (Cook & Friend, 1995; Roth & Tobin, 2002) do not capture the complexity nor the saturation of collaboration in the open plan settings. They represent strategies and insights stemming from a traditional setting.

The open plan spaces have established a pattern of practice that is necessarily intensified through high visibility and ongoing scrutiny in the form of public, often joint practice. The moments of collaboration occur frequently. Teachers are called on to negotiate previously centralised decisions on a daily basis. These include room use and teacher roles within team teaching scenarios. A traditionally arranged school would make such decisions at the beginning of the semester with little to no change throughout. Unspecified or open scheduling means teachers need to decide on resource allocation – space use, teacher roles – as a collective. Where spaces are not allocated, negotiation presupposes a plausible justification for any argument one might offer for the desired outcome. These decisions frequently occur while teaching is taking place. They are made *in situ*, often with a student and peer audience. Where teams are aligned the collaborative effort extends into planning, teaching, student management as well as assessment and reporting.

This extension of collaboration places further emphasis on the need to identify clear mechanisms of accountability in regards to preparation and reporting in particular. It is not unusual for teachers to prepare as a team in most settings; however, in the open plan settings the collaboration is such that if one team member does not meet their obligations it is possible that up to four teachers and more than 80 students will be impacted. Considerable pressure is placed on the team in the continuous cycle of work in the schools. Across all sites reliable, team oriented peers were reported as critical to the success of the team.

Reporting presented challenges for teams of teachers. During the early phase response teachers identified that some students were easily hiding in the large rooms. Teachers had to devise specific strategies for monitoring student progress. This

impacted lesson-based collaboration with targeted teacher movements and student-oriented engagement strategies. It also saw more systemised strategies such as identifying students at risk through diagnostics and assigning individual teachers to groups of students. This did not necessarily involve any change for the student but required the teachers to be far more agile in their approach to how they used the lessons and how they targeted particular students. This required collaboration in planning and ongoing communication and awareness within lessons. It was such insights during the early to mid phase response that informed the more sophisticated curriculum overlays.

Collaboration and Relational agency

Relational agency (A. Edwards, 2005) is used to orient the collaborative, team-based practice. The mutual goals of the team and use of artefacts in mediating relational agency and establishing common knowledge (Deed, 2015b; A. Edwards, 2011) are identified as the shared practice within the case study schools. While it is reasonable to identify these are the fleeting micro-negotiations described by Edwards (A. Edwards, 2011), it is reasonable to stress the critical nature of many of the negotiations. Divergence between the sites occurred by degrees with the presence of curriculum structures featuring centralised resources and schedules amplifying the mutuality of agency, particularly where these were mandated. The case studies provide the opportunity to contribute to the emerging picture of relational agency within the up-scaled open plan settings.

The patterns of usage at each school site indicated a necessity to the occupation of open plan spaces. The reporting of practice was dominated by a sense that the *'space demanded it'* (certain practices or behaviour) or that the *'space made it possible'* or was more likely where *'it just didn't happen'* before. This was also occurring at the same time as a clear need for balancing existing skills and expertise with the innovations taken up in the open space. The observed practice consisted of recognisable and altered pedagogy resulting in similar observations of practice: at once recognisable and different. The literature recognises the move to a new paradigm requires the bridging of tradition and innovation (Darling-Hammond & Bransford, 2005; Desforges, 1995;

McGregor, 2003a). Again, similarities dominated the data and variations occurred by degrees rather than distinct or stark differences.

Adaptive expertise

The literature identifying the shift in traditional practice dovetails with adaptive expertise. Adaptive expertise requires a balance between innovation and routine (Mercier & Higgins, 2013; Schwartz et al., 2005). Teacher articulation of practice was framed as *'acting differently'* and *'going on'* or *'getting on with'*. This was predicated on the idea of *'letting go'*. The need for innovation was present in the school level curriculum overlay. The teachers at each site also reported a need to respond as a necessity of the space. This required a shift in thinking and practice that responded to the established traditions and possible innovative manoeuvres.

Acting differently within the spaces is also related to the affordances of the context. This is based in the same understanding as articulated in teacher perception of affordances (Gibson, 1977; Greeno, 1994); however, here the particular contexts are understood as exerting an influence (Billett, 2009a; Deed, Lesko, et al., 2014; Hoekstra & Korthagen, 2011; Wilson & Demetriou, 2007). Affordance theory is established as a meaningful theoretical lens; however, the particular shape of schools presents challenges that require an account responsive to the specific context. The use of structures that are themselves a response to affordances but form further and ongoing affordances need to be given theoretical meaning. The divergence within the sites appears to be related to the specific curriculum overlay contexts in which the teachers are working as distinct from the broader context of an open plan space. The separation of the overlay as a factor can be established in light of unchanged, traditional practice continuing in the open plan spaces where an overlay was not present. Likewise, through the early phase of curriculum innovation the overlay provided optional participation that was not always enacted. The instances of enacted practice embracing the affordances of the curriculum overlay yielded the greatest level of innovation and adaptation.

Case study insights: Limited language to describe practice; need to recast collaboration; establishing enabling constructs

The case studies point to the critical features of adaptation between traditional practice and innovation within the open plan setting. The consequences for the lived experience of open plan settings are manifold. The data points to the following: limited language available to describe the emerging engagement with open plan schools; the need to recast the nature of collaboration; the central role of establishing enabling constructs through curriculum design. Teacher practice must navigate between existing traditions and requirements of the context as well as the affordances of the brute space and those constructs established as part of the broad response to the altered environment.

The data reveals a need for a contextualising of existing language used to describe the open plan learning environments. Terms such as flexibility and openness serve architects and planners but do little to convey meaning specific to teaching and learning. Educators drawing on ideas of personalisation and authentic learning were able to develop programs reflective of the quality teaching and learning outlined in Chapter Two. Terminology for describing the potential and emergent practice must reclaim the nomenclature of the spaces to reflect educational intentions. The inherent emptiness of architectural labels in these spaces are inadequate for the lived experience.

The complex, highly visible, dynamic and unresolved spaces established ongoing interactions with an impact on notions and experiences of authority and hierarchy. Ongoing joint practice further amplified collaboration in public, critical moments on a regular basis. This combines to impact existing ideas of collaboration. At a practical level the existing, albeit relatively small, literature on team-based teaching does not capture the complexity of the up-scaled open plan settings. This is reflective of the broader challenge of representing the work of teachers in the twenty-first century context. At a theoretical level the case studies provide an opportunity to establish a detailed context-based rendering of relational agency.

The key enabling constructs for enacting quality teaching and learning experiences are identified as those structures and tools responding to the possibilities of the open spaces while coupled to the various strictures of existing curriculum and socio-cultural expectations. This study draws on affordance theory to establish an organising construct capable of reading each school's progress toward achieving quality teaching and learning.

Embedded affordances: critical structures to create meaning in open spaces

The curriculum overlay at each school is characterised as embedded affordances. These are the school level innovations resulting from the affordances of the open plan settings combined with the particular context. The reading of affordances as complex arrangements offering multiple-possibilities is accepted within the literature (Boys, 2011a; Melhuish, 2011). Stratification of affordances into primary and secondary has been attempted within the school context (Deed, 2015b; Prain et al., 2015); however, the focus is on either the brute physical shell or fleeting and momentary instances such as Skyping or altered assessment. This study recognises the attempt at relative permanence with the curriculum overlays by each of the schools. Consistent with affordances as conditions for constraint or preconditions for activity (Greeno, 1994), each of the curriculum overlays established a further set of affordances working to bound and enable teacher practice.

The development of embedded affordance as a category takes its lead from the nested agency developed by Prain et al. (2013) to establish usable categories in examining agency within schools. In this way the concept has a parallel with existing and related theoretical constructs. *Embedded* is used to signal school level factors not normally controlled by individuals but present structures within which actors assert their agency. Agents might influence the embedded affordances in devising the overlay. The embedded affordances are often centralised and have currency through the entire context.

The concept of niches within affordances provides further orientation for embedded affordances. According to Gibson a niche is illustrative of the implicit reciprocity between animal and environment: “Ecologically speaking, a niche, although not literally a place, is a setting of environmental features that are suitable for the animal, and into which it fits metaphorically” (Gibson, 1977, p. 69). The embedded affordances are theorised as an attempt to establish new niches as situations where “one or more… abilities can be exercised” (Chemero, 2003, p. 192).

Graduated phases of response to open plan settings

The embedded affordances at each school site did not occur in a linear or progressive manner. Responses are recognised as occurring across a spectrum related to the established understanding of twenty-first century teaching and learning. The idea of phases of development in the novel settings of open plan is offered by Blackmore et al. (2011). The authors distinguish three phases based on whole cycle considerations: design phase, transition phase and consolidation. The significant focus of the phases centres upon the design and transition through construction. There is little in the details of the first two phases of concern for this study. The broad shape of phase three is more relevant. This phase focuses on the practice in open plan schools.

Blackmore et al. (2011) and others (Bligh & Pearshouse, 2011; Gislason, 2010) recognise the scarcity of literature specific to the practice of open plan schools. This study contributes an expanded empirical examination of enactment in open plan schools and uses the model of phases to understand the progression of practice in the case study schools. Where Blackmore et al. (2011) focus on design and building phases in their review of the literature, this study uses phases to plot each school’s practice against the development of twenty-first century teaching and learning established in Chapter Two: customised, authentic learner centred, collaborative, and ICT rich. In this way the progression of each school is represented on a scale: early, mid and advance phase.

Each phase created a set of conditions impacting teacher practice. The response at each school established a different set of conditions within which teacher adaptation could occur. At times the conditions were constraining – different classes in the same space with little scope for joint practice – and at others they were enabling – aligned classes engaged in a centralised discipline approach occurring in scaled instances. Each phase presented conditions requiring different skills from teachers. This study acknowledges that teacher skills are likewise developing in a graduated progression. The progression moves from traditional skills suitable for industrial era conditions toward agile and entrepreneurial skills suited to the twenty-first century context geared toward catering to learner diversity.

The three case studies are identified as occurring in overlapping phases of response to the up-scaled open plan settings. The studies revealed variation in the curriculum overlays, or embedded affordances at each school site. An outline of the embedded affordances at each site is provided below.

The specific responses to open plan settings were measured against the quality teaching and learning experiences established in Chapter Two. This saw the sites characterised as early, mid and advance phase. Advance phase response is considered to be practice that leverages the affordances of the learning space to provide learning experiences that are customised, learner-centred, collaborative, and ICT-rich. The intention is not to measure the success of each case relative to another site, but to position each on a continuum in order that the teacher practice can be understood. Neither is the intention to suggest a finality of development. This would contradict the central premise of adaptation. An imagined next step in practice based on emergent insights is offered as part of the discussion.

The monitoring of the sites across a two-year period meant that the studies presented responses at varying phases of development. While the research revealed considerable similarity of perceived affordances and teacher experience, the responses were also particular to the phase of development.

Central to the structure of identifying teacher skill sets in open plan settings is the understanding that the conditions occur as part of a graduated development at school level. The table below presents the graduated phases of response at each school site. The light blue oval represents the phase of practice when the study occurred.

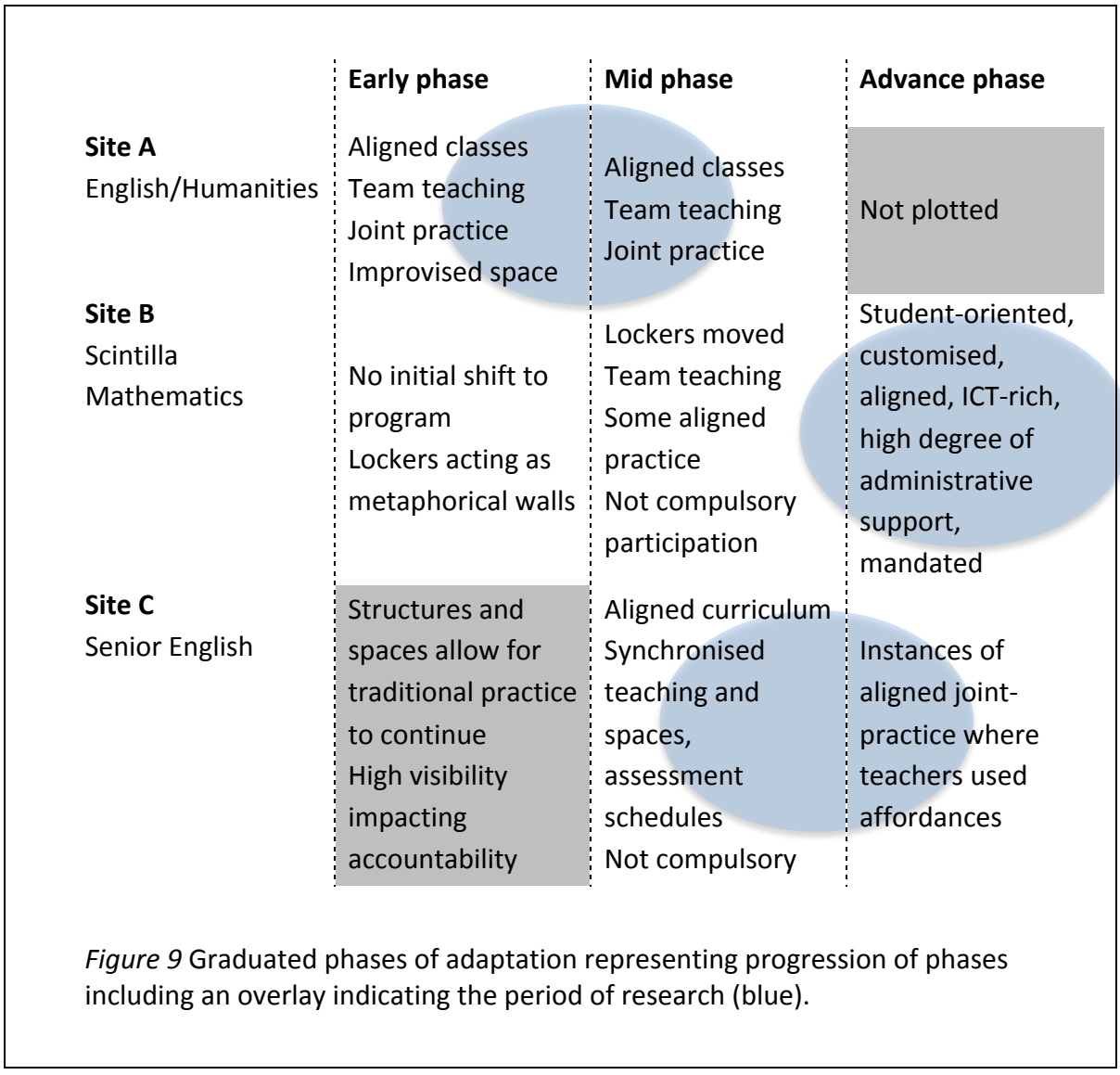


Figure 9 Graduated phases of adaptation representing progression of phases including an overlay indicating the period of research (blue).

Particular instances of responses at each site are provided to illustrate the contexts within which teacher practice occurred. This provides a frame for identifying similarities and differences in cross-case analysis.

Alluvial Secondary College: Early to mid phase response

Alluvial SC represents an early to mid phase response to open plan settings. The school's adoption of a converted library space to trial joint classes allowed it to implement aligned classes in English and Mathematics. Transitioning to the purpose built open plan spaces was reported as relatively smooth as a result of the trial phase.

Beyond the alignment of classes the curriculum program had not changed. Pedagogical innovation was limited to those instances of adaptation occurring in the teaching time itself, along with a generalised flexible approach to space delineation. In this way the Alluvial site is characterised as early to mid phase response.

Teacher practice in these phases share similarities with the other sites but offer only the beginning of the heightened practice observed at those sites.

Tellurian Secondary College: Early, mid and advance phase response

The early phase response at Tellurian SC saw a simple transfer of existing practice into the new open spaces; traditional single-subject, single classroom timetable arrangements. Banks of lockers were quickly employed as physical barriers acting as walls. Subsequently, there was little change to the program and significant problems with noise and student disruption.

The mid phase response is noted as commencing when slight shifts saw some alignment of classes and teachers working in teams to teach the curriculum. The Scintilla maths program experienced a mid phase response with the program elements in place using an opt-in model. Teachers could choose to not participate even when the aligned timetable, space and resources were in place.

Advance phase occurred with the mandated implementation of the Scintilla program. The advance phase involved a fully aligned program and synchronised timetable and curriculum enactment supported by centralised resource production.

Matassa Secondary College: Mid and advance phase response

Matassa Secondary College is characterised as a mid to advance phase response. The school started the design and build of the open plan space after the other BEP schools were complete and practice had commenced. In this way the teacher experience and the understanding of the progression from 7-10 to VCE informed design and subsequent practice.

The curriculum overlay at Matassa SC is different to both Tellurian and Alluvial in that a range of practices can be more easily sustained in the spaces. The building offered triple and double spaces with most able to be reduced to single space with operable glass walls. While the tight alignment of curriculum and centralised assessment was supported by a highly synchronised schedule, the shift from traditional practice was not mandated. Traditional mode of single teacher, single room was employed often, even amongst those teachers who chose to engage in innovative practices.

This study recognised the practice here to be across all three phases though the significantly altered physical surrounds were recognised as impacting the ongoing traditional practice as it occurred in highly visible, newly synchronised, settings. In this way Matassa SC operated in a mid to advance phase response to the open plan settings.

Cross-case similarities and embedded affordances

The following section discusses the collated responses to the broad categories of perceived affordances and teacher reaction against the embedded affordances. The impact of the embedded affordances, along with the broad scale affordances of the open plan space itself, can be seen in the teacher reaction results.

Teacher perceptions of affordances of open plan space

The case study sites revealed considerable similarities in the understanding of affordances of open plan settings. The open plan spaces were understood to offer a greater range of practice options and were generally seen as enabling. These include:

- Flexibility of space
- Increased scrutiny through high levels of visibility and joint practice
- Altered role of the teacher
- Altered (non-traditional) expectations of teaching and learning

Significant points of difference across the sites were not evident in the data. Slight divergence was noted in the particular understandings and realisations of the affordances. These were reflected in the school's position mapped against the embedded affordances.

Flexibility

Flexibility was broadly conceived as providing affordances for a greater range of practice. It also inspired a rethinking of existing traditions within the school. Flexibility was seen as enabling the initial embedded affordances (curriculum overlay) and the subsequent teacher reaction within the newly established bounds.

Early phase iterations focused on the particular strategy of team teaching while the advance phase understood the flexibility to be linked directly to learning and expressed through pedagogy. This was consistent across the school sites as they transitioned toward advance phase.

Table 12

Flexibility against phases

Flexibility	
Early to mid phase	Advance phase
Affordance understood as enabling innovative practice (team teaching) with a generalised focus on learning.	Affordance understood as enabling student-oriented, collaborative learning leveraged by innovative practices

Reading flexibility using the embedded affordances provides an opportunity to identify the context specific challenges and insights. Within this theoretical orientation

the flexibility assumes an education specific labelling. Terms like 'innovative practice', 'student-oriented', and 'curriculum overlay' now fill the void found in the architectural metaphors. These are not new ideas (or terminology) but assume a certain meaning when coupled with the open plan spaces. Innovative practice becomes a context specific response to the embedded affordances. In the case of Matassa SC, innovation was seen as targeted joint-practice leveraging teacher expertise in one-off instances. 'Student-oriented' becomes unscripted learning or agentic students. The idea that student learning might dictate the practice of teachers was understood in advance phase responses. This gives new meaning and a nuanced terminology to existing and known education language.

Visibility and scrutiny

Visibility and scrutiny were understood to afford a sense of agency – expressed as authority and hierarchy - within each of the open plan settings. The intensified scrutiny, constant interactions and collaboration contributed to an understanding of hierarchy and authority much altered from traditional models. The brute physical spaces presented primary affordances of high visibility with the phase of response influencing the degree to which hierarchy between teachers altered from the traditional. The mid phase response saw some breakdown of the hierarchy inasmuch as greater teacher interaction on specific strategies was required. At times teachers were required to negotiate practice and resources while classes were running. Some of these were simple or low-level interactions such as sharing video facilities, and others were highly charged moments centred on the shape of learning. However, these might be offset by periods of little to no interaction beyond watching the practice of peers.

The mid to advance phase response afforded greater teacher agency and required increased collaboration. The traditional mechanisms of hierarchy between teachers were reported as less influential in the fully open spaces of Tellurian and Alluvial Secondary Colleges. The absence of hallways or marked boundaries to formal teaching spaces meant that a student was unable to be removed from class in the traditional sense. Further, the strategy of deferring to a coordinator was not seen as an option. This was less likely to occur as teachers who could assist with poor behaviour

populated the open space. Moreover, the mid to advance phase response lead to teacher interactions occurred at such a frequency that asking for permission or seeking an authority was considered a waste of time.

The ongoing operation of the space was conducted with a clear sense of shared responsibility. Embedded elements such as not allocating spaces, or allowing for unscripted use of an oversized space, or teacher-determined space usage meant the negotiations became an ongoing part of practice in the open spaces further reinforcing the flattened hierarchy and sense of agency.

Table 13

Hierarchy and agency against phases

Hierarchy & agency	
Early to mid phase	Advance phase
Affordance understood as enabling episodic teacher agency through irregular or selective interactions reverting to traditional arrangements.	Affordance understood as enabling heightened relational agency through embedded, constant interactions focused on formal and informal moments.

Authority

The primary affordances of the open plan spaces were reported as impacting understandings of authority. The student cohort appeared to influence the degree to which authority between teachers and students altered. A general acknowledgement of improved relations between students and teachers is an accepted part of the Matassa SC narrative. The data from this site revealed little change in this relationship relating to the curriculum program or open plan spaces.

A contrasting picture emerged at the two 7-10 schools. The affordances of co-occupancy, high visibility and increased interactions were seen as impacting relations and creating a culture where authority was less overt: effectively, teacher and student agency was enhanced. High levels of scrutiny were reported as influencing the

behaviour of teachers and students alike. Students were aware of the constant presence of teachers in the facility and the general standard of behaviour noticeably improved.

Authority was impacted by the embedded affordances of the graduated responses specific to the pedagogical realisation in the two 7-10 schools. For example, the advance phase response at Tellurian SC required teachers to create video resources. Authority was altered when students associated all teacher authority with the author of the video. This created a specific understanding of authority impacting teacher work. Once the work of video creation was shared amongst the team the students shifted their focus from a single teacher. Mid phase responses did not produce a pedagogy specific response like that of the advance phase. Of note is the observation that mid phase responses saw students seeking assistance from teachers not formally linked to their learning. They regularly grabbed a passing teacher for help. This was especially so at the fully open plan sites. Similar breakdown in single-teacher thinking was reported at Matassa SC but this was not described as a dominant practice.

Table 14

Authority and agency against phases

Authority & agency	
Early to mid phase	Advance phase
Affordance understood as altering teacher authority through co-occupancy, increased scrutiny and unscripted access to support.	Affordance understood as altering teacher authority through co-occupancy, increased scrutiny and targeted support.

Altered role of the teacher: Teaching and learning expectations

The treatment of both analytical categories at once is justified by their interrelatedness. As explained above, the separation is to demonstrate the difference between affordance of practice and the beliefs that underpin such considerations. The altered role of the teacher was directly related to the phase of response at each school site. This was most evident in advance phase responses but was also reported as part of

mid and early phase responses. The reporting of difference was against traditionally arranged or pre-open plan practice. The perceived affordance of the space was amplified by the emerging embedded affordances. As teachers understood the possibilities of the space – the action possibilities of the embedded affordances – the role of teacher became less defined by existing ideas. The role of teacher was linked to beliefs about teaching and learning and appeared enhanced by the structures in place. Beliefs about what was possible and the importance of shifting away from traditional practice was reported as shifting after spending some time in the space enacting the curriculum program.

The specifics of the role change related to affordances of relationships with students and pedagogy, with the latter more pronounced in advance phase settings. Relationships were reported as more critical and more easily facilitated in the open settings. This had the general effect of shifting the role of teacher toward community builder and making the setting seem more democratic. Within the advance phase the affordance was more directly related to the enactment of pedagogy and teaching practice.

Table 15

Altered role of the teacher & teaching and learning expectations against phases

Altered role of the teacher & teaching and learning expectations	
Early to mid phase	Advance phase
Affordance understood as altering the potential practices of teachers generally. A broad sense for the need to change was present but not always implemented.	Affordance understood as altering the action possibilities directly related to the curriculum overlay. Beliefs about teaching and learning were in line with twenty-first century ideas.

Teacher reaction to open plan spaces

A cross case analysis of teacher reaction reveals a considerable relationship between the embedded affordances and actualised practice. The open plan settings were reported as establishing conditions for a demanding experience generally with a

heightened focus on pedagogy, relationships and innovation in advance phase iterations.

Similarities were noted in the teacher reaction to open plan spaces. Differences were understood to relate to the embedded affordances with the sophisticated responses approaching the quality teaching and learning outlined in Chapter Two amplifying the practice reflected in the analytic codes. These include:

- Collective practice
- Team orientation
- Necessity of space
- Adaptability

Collective Practice

Teachers across all sites reported a dramatic increase in peer-to-peer interactions in all phases of occupying the open plan settings. This represents a clear variation from traditional practice. This required teacher adaptation from isolated practice toward shared spaces and public practice.

Early phase responses understood collaboration as relying on favourable personality alignment and harmonious views of learning. Collective practice in early phase responses proved to be irregular and lacking cohesion. The focus appeared to be on teaching as distinct from learning outcomes of students. In this phase teachers expressed the adaptive practices of team teaching in technical terms and their articulation of their endeavour did not stretch far beyond the challenges of implementation.

Mid phase responses tended toward a degree of learning-focused collaboration. This meant some instances of collective practice were achieved regardless of personnel but it was still reported as a problem 'at times'. Where practice regularly returned to a single-teacher scenario, the instances of collaboration occurred less often and tended

to rely on favourable alignment of teachers or where one teacher 'accommodated' a colleague.

Advance phase responses focused collaborative efforts on pedagogical moments. Collective practice was not expressed as accommodating others but as leveraging strengths to achieve learning goals. A central unifying belief about teaching and learning was articulated in the advance phase and was used to drive the initiative.

Table 16

Collective practice against phases

Collective practice		
Early phase	Mid phase	Advance phase
Collective practice understood as enabling joint practice when teams consisted of teachers with shared views.	Collective practice understood as enabling joint practice 'at times'. Joint practice relied on accommodating others.	Constant collective practice understood as enabling the skills of all team members.

Team orientation

The increase in peer interactions and the necessary move away from private practice heightened the need for team orientation. Single-teacher operation of the up-scaled spaces was difficult to maintain in the two junior campuses though it was more easily achieved in the senior setting with movable clear walls.

In this way the early and mid phase responses saw a toggling between traditional and team orientation. It was reported that team orientation was preferable in order to achieve the potential of the joint practice initiatives; however, there were still teachers pursuing private practice. Where the embedded affordances allowed for selective participation the tendency was for single-practice to dominate except amongst those teachers embracing the curriculum program.

Of note is the observation from Matassa SC that the vision for teaching and learning did not necessitate the collective practice that would demand team orientation. Joint practice was considered powerful when targeted. It was used at point of need as distinct from ongoing. The success of those instances where targeted joint practice did occur appeared to rest on the team-orientation of the participant teachers.

Teacher reaction in the advance phase saw team orientation as a necessary component of a successful program. Observation of the advance phase practice at Tellurian SC demonstrated the spread of this understanding in the actions of the relief teacher participating for the session. Prior to the lesson he negotiated his role with the usual teacher and committed to this throughout the lesson. The irregular structure of the class and dynamism of the student-oriented physical space might have been confronting but he applied himself to the collaborative practice conscientiously.

Table 17

Team orientation against phases

Team Orientation	
Early to mid phase	Advance phase
Team orientation is preferred and allows for instances of successful collaboration.	Team orientation is necessary for and is a product of intensified collaboration.

Necessity of space

All three case study schools revealed teacher reaction to involve a response to the necessity of the space. The open plan settings proved to be significantly different to the traditional model and the break from tradition was stark. The addition of the embedded affordances amplified the need to steer a path through the traditional practice and innovation. The sophisticated interpretations of quality teaching and learning were understood to focus this amplification.

In the early and mid phase responses informants articulated the general position that something had to change; that "*we can't keep doing what we've been doing"* (Teacher C). This attitude was a direct reaction to the space. The theorised schoollessness or unwalling of the classroom (Deed & Lesko, 2015; Deed, Lesko, et al., 2014) was present in the initial reactions by teachers.

Advance phase responses drew on the possibilities of the space and had progressed to interpreting the open plan setting as an opportunity to innovate. The goal at each site is broadly characterised as personalisation. The embedded affordances at Matassa SC established a set of conditions that were at once an innovation in overlay and required innovation by teachers. The English curriculum favoured point-of-need personalisation through judicious use of teacher expertise. Within the embedded structures the teachers had scope to change and adapt their teaching to better accommodate student need.

Participation in the Scintilla mathematics program at Tellurian SC necessitated certain behaviours that were in themselves innovations: minimal teacher instruction time, use and creation of video resources, joint teaching, and dynamic peer-to-peer negotiations while teaching. The move to stage-based as distinct from age-based curriculum also demanded a more detailed knowledge of curriculum, familiarity with student abilities and performance levels, as well as a capacity to assess using non-traditional forms such as the student blog.

At times practice at each of the schools demonstrated certain non-negotiables but the advance phase resulted in a constant demand for innovation and adaptation.

Table 18

Necessity of space against phases

Necessity of space	
Early to mid phase	Advance phase
Space was seen to establish a rethinking of existing practice. It provided a broad sense of the impetus to change practice.	Space *and* embedded affordances were seen to amplify the need for change and established non-negotiable adaptations. This demanded a rethink of practice and underlying beliefs.

Adaptability

Teacher adaptability offers the clearest means of framing the reactions to the embedded affordances. The degree of adaptability appeared related to the phase of practice in relation to the embedded affordances. Early to mid phase responses contained primary affordances requiring adaptations that were a marked break from pre-open plan practice – increased interactions, heightened emphasis on relationships, public practice – but could be avoided or dulled at times by choosing not to participate in the embedded affordances. By contrast, the advance phase response demanded adaptability to the general, brute affordances of practice in the space as well as unavoidable participation in the embedded affordances demanding adapted practices focused on pedagogy. This required high-level skills of diagnosis and intervention in amplified settings requiring constant, often fast-paced interactions with teachers and students on various scales. At times the interactions were quiet and required sensitivity, while at others the interactions were with large groups requiring a presence across the large-scale space.

The difference between early and advance phase teacher reaction is one of degrees and is related to the participation of the teacher in the overlay offerings. Where the embedded affordances were strategically designed to achieve twenty-first century teaching and learning the adaptation required was exaggerated. The mandated participation added to the extent of the participation and further magnified the adaptations.

Table 19

Adaptability against phases

Adaptability	
Early to mid phase	Advance phase
Brute space resulted in more interactions, emphasis on relationships and public practice though practice often reverted to traditional model.	Space *and* embedded affordances saw an unavoidable intensification of practice as well as adaptations focused on pedagogy personalising learning.

Beyond Advance phase responses

This study has observed the response to open plan school settings as occurring in early, mid and advance phase. The advance programs and practice in response is not imagined as the end point in a series of orderly progressions. They are offered as a response seeking to enhance the possibilities of the school space in service of a vision of twenty-first century learning.

Development on the advance phase responses may seek to enhance the agency of students through individual control of engagement through assessment or curriculum construction. Schools may seek to establish less discipline focused subject offerings and move to global or problem-based project learning where students plot their learning against the curriculum markers as they correspond with elements of their project. The mutuality inherent in such a scenario is obvious. This would further alter the role of teachers and have significant consequences for understandings of teacher authority, knowledge structures, and the role of space and time within the school setting.

Concluding remarks

The embedded affordances of the structural overlays provided a further layer of enablers and constraints impacting on teacher experience. The sites revealed considerable similarities in perceived affordances and reactions with variation occurring in relation to the particular curriculum program. The programs considered advance

phase appeared to create a more sophisticated pedagogy-focused set of affordances with learning as the critical focus where early phase interpretations remained wedded to teacher practice with a particular focus on team-teaching. Subsequently, teacher reaction in the advance phase required greater degrees of adaptation due to the heightened conditions and break from traditional practice.

Teacher adaptation: theoretical considerations

The impact of the affordances of the open plan settings on teacher practice demands a reconsideration of the theoretical understanding of adaptation. Where existing models are largely cognitive and focus on teachers adjusting their practice or views through a steady engagement with stimulus material (usually in the form of professional development), this study reveals a less predictable and sequential progression.

This study observed teacher responses and adaptions that were far from consistent and, oftentimes, cognitive development occurred after practical immersion. The impact of embedded affordances was such that the environment stimulated the adaptation. It was not possible for teachers to ignore the changed setting and when combined with the structural overlay the need to adapt was understood as necessary.

The consequences for existing theoretical accounts of adaptations are for an expanded understanding of how adaptations occur. The cognitive reading of adaptations may need to yield some ground for a more biological reading drawing on evolutionary frames that focus on adaptation from necessity and opportunity. The interconnected model of Clarke and Hollingsworth (2002) provides a starting point with an emphasis on multiple growth patterns and change sequences.

In the same way as an evolutionary reading focuses on survival stemming from suitability and advantage, a revised account of adaptation could draw on notions of necessity, sufficiency, survival and advantage. This is not to overplay the biological metaphor, though teachers who left in response to the open plan setting were referred to as casualties; rather, it is to expand the idea that adaptations must come from within,

or be neatly organised as an offering for reasoned changes. This study has found that adaptations can be made necessary by the environment and the impact exaggerated through careful embedding of structures and guiding philosophies or principles.

Assessing theoretical constructs against the cross case analysis

Agency and rationalisation

This section examines the cross-case analysis against the theoretical constructs of structuration and relational agency. The use of affordances as a sensitising lens is also considered for adequacy and suitability.

> Structure is regarded as rules and resources recursively implicated in social reproduction. (Giddens, 1984, p. xxxi)

Structuration is premised on the centrality of the reflexive loop (Giddens, 1984). The loop sees structure created through ongoing agent choice; monitoring of action in light of the *milieu* of daily life. Critically, the focus on rationalisation as a process is key to the strength of the theoretical construct for this study. The reflexive monitoring presumes a level of agent competence. Agents must engage knowingly and as cognisant players in the construction of the structures around them. Giddens asserts that social systems are "grounded in the knowledgeable activities of situated actors who draw upon rules and resources in the diversity of action contexts, are produced and reproduced in interaction" (Giddens, 1984, p. 25).

Knowledgeable activities in novel spaces

The novel open plan settings bearing limited resemblance to traditional models of school spaces establish a jarring or discordant perception. Thus, the novel settings demand a deliberate engagement in navigating existing practice with innovation. The claim by Giddens that recursivity occurs as 'knowledgeable activities' is evident in the open spaces as they force teachers to shift their practice and beliefs. A central understanding of the brute space was the undeniable impetus to change. Leaders in the open plan settings reported the desire to get teachers to engage deliberately with the spaces: to choose pedagogy before space, to allow students and their learning needs to

dictate usage. The amplification of disruption occurring in the embedded affordances further emphasised the compulsion to reimagine or reconsider practice in the new spaces.

As well as the necessity of the reconsidered response, the embedded affordances established an ongoing need for adaptation. The adaptation involved a reorganising of teacher practice that focused on collective practice and team orientation. Structuration theory is premised on the idea that the social systems give rise to the structures appearing as both condition and consequence of the interactions between agents (Giddens, 1976). The novel settings gave rise to emergent practices. In a way, as new systems emerged, the setting offered a glimpse of structuration theory enacted. A complicating factor arose in the navigation of existing traditions of practice with the need for innovation.

Relational agency

Relational agency focuses agency on those instances of negotiation that are joint focused and object oriented (A. Edwards, 2005). The characterisation of the interactions as fleeting micro-negotiations (A. Edwards, 2011) proved salient to this study with the marked increase in teacher-teacher and teacher-student interactions as part of the general occupying of the space. The embedded affordances geared toward joint-purpose pedagogy exaggerated the volume and frequency of the negotiations. A focus on these micro-negotiations as revealing of agency receives justification in this theoretical frame.

Relational agency also served to orient the focus on collective practice. Relational agency is both mediated by common knowledge, which Edwards explains comprises the motives of the actors (A. Edwards, 2011), and is where common knowledge may also be built. The distributed expertise found in the negotiations was observed in the concrete instances of simultaneous teaching in teams and through preparation and marking. Further, the design of the curriculum in the advance phase looked to actively exploit the expertise of the team in planning and execution of the

program. In this way relational agency was necessitated by the conditions of the open plan spaces and the embedded affordances.

Tensions are recognised within an agentic reading of the data in that the friction between individual and collective interests are still present (Fullan, 1993b; A. Hargreaves, 1994). The necessity for sacrificing the needs of the individual for those of the group is present in teacher responses to practice in all phases of responses. In the early phase the sacrifice was considered worthwhile on account of improved relationships. In the mid to advance phase response the focus shifted to the need to adhere to the vision of teaching and learning in order to achieve positive outcomes for students. This appeared an easier sacrifice to make though tensions were still evident. The tensions at this point were expressed as missed opportunities to be responsive to current issues or student-driven tangents given the need to remain on the central schedule.

Relational agency in up-scaled open plan learning environments

The case studies provide an opportunity to develop a context-specific rendering of relational agency in an open plan school setting. Using the key ideas developed by Edwards (A. Edwards, 2005, 2011) and Edwards and D'Arcy (2004) a detailed phenomenological account of theoretical categories is offered. The key ideas are micro-negotiations, mediation and common knowledge/distributed intelligence.

Relational agency is presented as a two sage process that rests on a continuous dynamic where practitioners have a concern for expanding the 'object of activity' or 'work problem' (A. Edwards, 2011). The second stage involves aligning new responses with the "newly enhanced interpretations with the responses being made by other professionals while acting on the expanded object" (A. Edwards, 2010, p. 14).

Relational agency was employed to examine a school setting by Edwards and D'Arcy (A. Edwards & D'Arcy, 2004, p. 154) with a recognised strength in placing emphasis on giving and seeking support in "joint action on the object of activity to

expand mutual understandings of the object". Where Edwards and D'Arcy focus on the capacity of student teachers to recognise and enact relational agency amongst students, this study expands the use of the theoretical tool to take in teacher-teacher interactions within the open plan setting.

Fleeting interactions and micro-negotiations

Edwards describes the realisation of relational agency as often fleeting object-oriented joint-action (A. Edwards, 2011). These occur as micro-negotiations between professionals mediated by artefacts. A significant increase in interactions was noted as a central feature of occupying the open plan spaces. The interactions occurred between teachers and teachers, as well as teachers and students, and between students in formal and informal scenarios across a range of locations in the settings. They were often decisions being made in service of student learning with a particular focus on attempts at personalisation through vertical arrangement of curriculum. This example begins to suggest the type of expertise emerging as critical to success in the new settings.

The micro-negotiations occurred between teachers in preparation and in practice. They often took place opportunistically: immediately prior to class, or within class time. Where joint or aligned teaching occurred the negotiations were a central feature of the collaborative practice. Implementing stage-based practices demanded knowledge of curriculum and students requiring regular *in situ* sharing between teachers to achieve success.

Outside teaching time, students and teachers interacted more frequently as well. Students often requested help from teachers sitting nearby or passing through the open space. This was usually related to the task at hand but may have been related to pastoral care as well. Likewise, teachers could use the informality of the space to enter a 'class' at any time and seek out a teacher or student. This could be related to professional development, an ongoing or existing issue or be related to a student's behaviour unfolding in the class. These interactions were usually not formal and lasted

for short periods. A behavioural-based interaction may be as minor as a teacher standing up at their desk and making eye contact or moving strategically to be seen by a student. Likewise, a brief contact could be made via fleeting conversation. Such interactions are in line with A. Edwards' (2005) conception of individual change rather than transforming the system.

Mediation: negotiating resources in the open plan setting

Mediation occurs through the negotiation of resources or artefacts by two or more individuals (A. Edwards, 2005, 2010). Oftentimes, these occur at the boundaries of practice and in the heat of action (A. Edwards, 2011). The open plan settings engaged in advance phase responses presented multiple opportunities to identify mediation of relational agency. Relational agency at the boundaries involves the challenge of negotiating expertise within a frame that is focused on understanding and expanding a sphere of influence (A. Edwards, 2011).

Boundaries of practice are considered those instances of negotiating expertise where the professional cannot necessarily control the practices. The highly collaborative work in the open plan settings saw expertise negotiated through planned distribution of expertise and *in situ* responsive team-based teaching. The fluid and unfolding teaching demanded that expertise be considered in planning, implementation, and reporting. Teachers negotiated their expertise in teams centred on the student or piece of pedagogy as the object of activity. This occurred as part of the milieu of the open plan school.

Taking Edwards' (A. Edwards, 2011) identification of essential features of boundary work for establishing common knowledge as a lead, the features emerging from the advance phase response settings are identified:

- Focusing on the individual trajectories of progression for students
- Awareness of teaching and learning vision (for quality)
- Awareness of sphere of influence and expertise within curriculum overlay
- Negotiating instances of resource use *in situ*
- Understanding purpose of collaborative pedagogy

- Being team oriented
- Willingness to be adaptive, to 'jump in' despite uncertainty
- Reflecting and responding in all parts of work: planning, implementing, marking, and reporting

Relational agency: Turbo-charged resources in open plan schools

The advance phase response saw a collaboration that paralleled with Edwards' idea that colleagues can be recognised as a resource. Moreover, that, "work needs to be done to elicit, recognise and negotiate the use of that resource in order to align oneself in joint action on the object. It offers an enhanced version of personal agency" (A. Edwards, 2005, p. 172). The enhanced version of agency was present in the need for individual teachers to engage with the space deliberately as a rational agent and made non-negotiable by the volume of interactions that made up the ongoing daily life of the space. An example is seen in the necessity of choosing a space to match pedagogical intent utilising available resources relevant to student outcomes. Specifically, identifying and enacting point-of-need team teaching requires recognition of student need and available resources in the form of colleague expertise, as well as negotiating the resources and physical space in line with the curriculum and student learning.

In the same way micro-negotiations revolved around practice geared toward stage-based curriculum, negotiations in planning and reporting on the learning extended agency beyond the teaching moment(s). Achieving broad-scale settlement on the embedded affordances involved relational agency. The advance phase response is a sophisticated distribution of expertise to maximise personalised learning through the embedded affordances. Beyond this structural set-up, the ongoing planning, monitoring and reporting were seen as the artefacts at the centre of the mediation of relational agency.

Edwards' idea that resources can be both material artefacts and specialist concepts and insights specific to practices within a profession (A. Edwards, 2009) further shapes the reading of relational agency in the open spaces. The mediation of

relational agency was encouraged by the embedded affordances. The particular expertise of individuals could be harnessed by the structure yet remain centred on the idea of personalised learning in the daily routine. The common goals, as well as ideas of education underpinning the advance phase curriculum overlays anchored the concepts and insights for teachers while allowing individual expertise to contribute to the situation.

Common knowledge and distributed intelligence centred on the enactment of personalised learning in open plan learning spaces.

Edwards (A. Edwards, 2010) identifies common knowledge as being built in boundary spaces and generating subsequent collaborations imbued with relational agency. These collaborations centre on fluid and responsive joint actions to complex problems drawing on common knowledge.

Edwards observes that from these experiences practitioners recognise the distribution of expertise across settings and "bring to bear both their core expertise and an additional form of expertise… relational expertise" (A. Edwards, 2011, p. 33). Though the setting is limited to a single school, and is thus different to the intended focus on the joint work of discrete activity systems, the work emerging in the open plan settings can be characterised as a coming together on common activity unlike previous iterations of teacher practice. The co-location of discrete disciplines in a single community intended to work as a cohesive unit enacting the curriculum is a case in point.

Teacher agency in the advance phase open plan school is necessarily collaborative. The creation of common knowledge is considered a central feature of the practice occurring in the open plan settings. It revolves around each student's progress within the vision for teaching and learning. Teachers regularly drew on common knowledge specific to the learning structures, individual student progress, formal procedures and tacit understandings for organising groups within the space, responding to disruptive students, handling poor student behaviour, and knowledge around modes of negotiating with peers. The study found that the common knowledge was

established quickly though required support through formal procedures, especially in the early phase responses. As the responses became more advanced, so too did the common knowledge become clearer.

A particular example can be seen in the teacher work specific to stage-related curriculum. Teachers were required to negotiate on individual students through the planning and implementation phase. This required common knowledge specific to the curriculum program and learning tools – curriculum progress, expected levels, and familiarity with tasks able to advance skills – as well as individual progress. Teachers were required to know when and how to move students along their learning trajectory. The common knowledge centred on the student trajectory appeared to establish a hierarchy of knowledge. All other arrangements were subservient to the key goal. If a situation called for – and could be justified – bringing all students together to listen to a single teacher at a non-scheduled moment, then the teachers worked to make this happen. This might be opposed to the formal procedures around student movement or single-teacher practice. This is in contrast to early phase responses where common knowledge around procedure seemed to be the significant concern.

Mutual agency: An advance on relational agency in open plan school settings

An advance can be made by understanding the developing agency within open plan settings as mutual (Deed, 2015b). The agency of teachers and students in a school setting is reasonably understood as interdependent (A. Edwards, 2011) with the resultant focus on co-regulated learning leading to mutual agency. The difference to relational agency is subtle. The addition of the reflexive loop (Giddens, 1984) in modelling mutual agency accounts for the rich interactions and reciprocity of the practice that is ongoing "immediate… reactive, and typically complexly grounded in the environments affording agency" (Deed, 2015b, p. 51).

The reflexive monitoring of relationally agentic moments establishes mutual agency; a dynamic, reciprocal set of interactions jointly focused on the artefact and maximising the resources of practitioner expertise and the possibilities of the space. It is

necessarily responsive and depends on the alignment and synchronicity of resources; structural, team-based, and individual. The greater the focus of these combined resources on a shared vision of teaching and learning, the greater the occurrence of mutual agency.

An example is seen in the advance phase Scintilla maths program. Successful implementation requires teachers to be cognizant of the central goals of the program; namely, the personalised progress of individual students. In this way the broad alignment of a vision is achieved. The advance phase program in Scintilla maths and at Matassa SC saw teachers adjust their practice to actively seek the expertise of colleagues during teaching moments. This took the form of teachers directing students to other teachers specific to their expertise as well as seeking out that expertise for their own development. The synchronised and aligned teaching allowed teachers to be relationally engaged in the process while it was happening. A constant monitoring of their practice – in synch with their colleagues – meant that the agency shifted from relational to mutual.

The type of pedagogy required to achieve such a scenario is emergent. A lead can be taken from the idea of mutuality and agency generally. Keeping in mind the outline of quality teaching and learning this century it is posited that agentic pedagogy aiming for mutual agency is desired. The requisite reciprocity demands that this be guided by personalisation and authenticity with the role of the teacher as leader/curator of the experience affirmed.

Desirable features of quality teaching and learning: Mutually agentic pedagogy

The established vision of teaching and learning and emergent practices observed in the open plan settings provides an opportunity to examine desirable features of pedagogy capable of fulfilling the idea of quality. The idea is not to present adamantine descriptions or unyielding decrees. It is, rather, to suggest the preferable shape of achieving mutual agency in practice and pedagogy. The task can be divided into features of process and features of quality – condition or character – of the teaching and learning.

The process has been identified through the data as relying on a maximising of the available resources through strategic use of the physical space and available expertise of the teachers. The up-scaling of classes into aligned and synchronised programs of curriculum enactment allows for a distribution of expertise not present in private practice or 1:25 classrooms. Moreover, the use of ICT to offer centralised staged curriculum resources enhances teachers' ability to cater to a range of student abilities and interests. The use of space and curriculum structures in this way allows for greater degree of personalisation for students and frees teachers from lock-step progression through mandated curriculum. Of course, this is predicated on the belief that students are capable of making progress without the constant presence of the teacher, at least in the traditional sense.

The character of teaching and learning achieving the agentic goals of the quality established in Chapter Two can be outlined. The type of practices emerging in the open plan spaces enhancing student agency places students firmly at the centre of the transaction. This means students genuinely control their learning through choice on elements such as ability level, task choice, choosing their learning partners, negotiating with their learning peers, choosing how they engage with the physical resources, determining which teacher expertise they access (personnel) and how (in person or virtually). Further, students assume control of their mode of assessment and the up-keep of their submissions.

The reshaped agentic pedagogy is much more than a cursory nod to student choice by way of shifting the furniture; it is decisively 'beyond the beanbag' (Boys, 2009). This is a hyper-version of personalisation where students have a clear sense of ownership of their learning and deploy the resources of space and teacher expertise to affect personal outcomes. The role of teacher in these settings is fundamentally altered. Practice is altered through the joint focus on student learning. In constantly negotiating the physical and intellectual resources to impact learning teachers must be team oriented and capable of 'live' reflection on the artefact, as well as the capacity of themselves and others to produce the curriculum. This is a continuous and dynamic process in the service of ongoing assessment and development of individual students

within small, medium and large groups as they progress toward sustainable learning relative to their existing level.

The emphasis of student agency is seen in the frustration of students who are made to work with others not familiar with the student-driven processes in the Scintilla program. Student irritation with the joining of two classes at varying points of take-up in the new program is only partially about logistics. Their chagrin runs to the philosophy of the program. They keenly felt their learning slowing and their productivity being compromised during the adjustment phase. This indicates a reasonably established culture where learning occurs in certain ways and the presence of untrained others can interfere with that.

The core features of quality teaching and learning can be summarised. Such learning features genuinely empowered students with control over physical resources, resources of expertise and control of their own output through choice of assessment mode and monitoring, as well as some control over selection and progress through stages of curriculum. Students exert agency in choice of peer groupings, negotiation of learning space usage and access to teachers.

This is supported by agile teachers adapting mode of engagement ensuring access to relevant resources, capable of authenticating learning in a range of assessment modes. Practice becomes team-oriented, pedagogically agile, artefact focused, responsive, reflective of self and team, and capable of assessing and harnessing resources of space and peers to maximise learning.

Reflection on the use of affordance theory as orientation for this study

The ecological basis and subsequent extension of affordances has served as an orienting theory throughout this study. The ontology of affordances focuses on the real possibility and complementability. Likewise, the affordance is categorised thus on account of the activity being supported (Turvey, 1992). The theorising of embedded affordances arose from the deliberate manipulation of the primary affordances at school level. At a concrete level the newly established affordances arose from and

necessitated the practice it intended. It could not *not* have supported the action it intended. This may appear tautologous; however, it is instead the manipulation of the surrounds to achieve an outcome grounded in ideas of twenty-first century education. It does not corrupt the central insight that affordances do not cause behaviour; rather, they productively constrain it (Gibson, 1977; Greeno, 1994).

The ongoing tradition of autonomous, singular practice regularly resulted in little or no change. The greatest variation from the traditional occurred when the embedded affordance was made mandatory by the school administration. The openness of the spaces demands a further intervention by the educators to install a shape and establish sense and order where traditional prompts such as rooms and timetable are missing.

The ability to characterise the system overlays as embedded affordances in particular assisted in the cross case analysis particular to the contexts. As the contexts were physically similar and joined by broad currents of pedagogical development, yet positioned variously in a stage-based development, the frame of embedded affordances served as a usable framework consistent across all three sites.

The concept assisted in framing the interview questions and the data analysis. Teachers were more likely to use language like enabler and constraint; however, 'affordances' proved a useful and familiar concept through the member check stages of data collection. Affordances were also present in the architecture and education literature and served to unite my thinking around data analysis.

The concept of affordances is problematic in analysing the social practices of agents (Costall, 1995; Stoffregen, 2004). This study recognises affordances as occurring in 'humanised nature' whereby it meets Gibson's requirement as real (Costall, 1995) and as sufficiently broad to include all social activities; affordances are *emergent* properties of the animal-environment system (Stoffregen, 2004).

The Penrose Effect: Characterising the open plan experience

Attempts at characterising teacher practice in the open plan settings using metaphorical devices are not a feature of the literature. This is predictable given the novel status of the practice. The development of a metaphor capturing the work of teachers within the up-scaled open plan settings can contribute to the research and practice in this area.

The Penrose triangle serves to capture the mix of traditional and innovative practice present in the up-scaled open plan spaces. It is a metaphor for the phenomenological experience of engagement in open plan school settings. It is an easily recognised impossible object. It is at once jolting and familiar. It resembles a known object and is made of easily recognised shapes yet it remains difficult to perceive. It creates dissonance and requires the observer to continually adjust or reassemble the object for it to make sense. On one level it is a visual illusion yet the power of the object stretches beyond gimmickry. It asks the viewer to consider perspective much like the use of trompe l'oeil requires a constant re-examining or readjusting. One cannot simply settle on the object and achieve a resolved effect. The adaptation is ongoing and necessary.



Figure 10 The Penrose Triangle

Existing attempts at developing figurative insights specific to open plan settings have been limited to capturing intentions as in 'beyond the beanbag' (Boys, 2009) or the potential of openness expressed in design metaphors like 'useless spaces' (Jilk, 2005) and 'finished beginnings' (Barret & Zhang, 2009). These usually relate to the inherent fluidity in an attempt to highlight flexibility. Reading the school space within an ecological or environmental frame (Klopfer, 2011) lends itself to suggestions of fertility and complexity but, ultimately, they each fail to represent the practice of teachers.

A formula for representing the potency of a learning space (open or otherwise) is offered by Barnett (2011). The formula is recognised as an attempt at an elegant representation of a complex scenario.

> availability (of learning spaces) + a will to explore + pedagogical encouragement = potency (R. Barnett, 2011, p. 172)

The formula remains an attempt at capturing potential as opposed to the lived experience. The effort proves inappropriate for capturing practice and reveals the limits of representing lived experience. Nevertheless, it captures something of the components of the complex situation that is the dynamic open plan learning settings.

The Penrose triangle offers a figurative equivalent of the up-scaled open plan settings. Teachers must respond to the necessarily altered school setting while drawing on the traditions of practice that constitute teacher knowledge and the expectations of the particular subject discipline. It is at once vexing and easy; irregular and known; divergent and habitual; contrary yet plainly evident. It is simultaneously antagonistic and harmonious. It is in a state of becoming while emanating from traditions of being.

The Penrose effect in up-scaled open plan schools

The Penrose effect in up-scaled open plan schools sees practice in the new settings as anchored in a heritage of ideas and experience yet lost in a version of school that is discordant and agitating. It requires a constant readjusting to establish meaning and reattach to the recognised shape. Practice under the influence of the Penrose effect is both alien and counter-intuitive yet formed from the conventions of the institution.

The Penrose effect is offered as a bridging metaphor in this field. It captures the tension in the open plan settings and acknowledges the considerable task of reconciling the unknown with the known. It communicates the counter-conventional with the resolved and established knowledge of teacher practice and school structures. The figurative expression has currency inasmuch as traditional practice is still a dominant reference for emerging practices. Perhaps, once practice in the open plan spaces has evolved to something removed significantly from the traditional, a new metaphor, not based on disruption and dissonance, will be required.

Teacher curator: An image to represent complex practice in open plan settings

The Penrose triangle as metaphor is limited. It captures the teacher reaction to the open plan settings and communicates the need for deliberate engagement and ongoing reflexive monitoring of the activities in order to maximise the potential of the

teaching and learning. However, the act of teaching itself is little served by the image. A further explanation is needed to make sense of practice in the spaces.

Teacher curator is offered as an image that serves to bridge existing constructionist models of teaching with the practices emerging from the open plan settings of this study. Using the three key insights generated by the study the image of teacher as curator can be assessed for usefulness: limited language available to describe the emergent practice; emphasis on role of agency (relational agency tending toward mutual agency); and the critical nature of embedded affordances in the form of curriculum structures geared toward maximising the potential of the setting.

Teacher curator as boundary setter

Traditionally, the curator establishes the boundaries and content of the art experience. The expertise of the curator is used to establish the dimensions of the experience and the selection of material. This occurs as part of a larger discourse on cultural forms, art history, ideology, technological development, reputation, promotion, exploration, trends and public interest. The twenty-first century context has led to the recasting of the role of curator. The fluidity of boundaries between virtual and physical, digital and analogue, interpreter and agent is a feature of the contemporary role (Proctor, 2010). Not unlike education – though perhaps more recently – museums and galleries have shifted from a model of exclusivity and singular representation to one that is more inclusive, open, and explores the role of participants as co-curators (Edson, 2014; Fowle, 2007).

It is important to note that the metaphor is not intended to over emphasise the idea of manipulating space. The open plan learning spaces are not interpreted here as an exhibition space equivalent. The heritage of the metaphor sees it sit comfortably in the new environments taking in unique spatial dimensions; however, the metaphorical links are intended to take in more than the administration of space.

The emerging image of curator in the twenty-first century is one that is responsive, adaptable, and user-focused whilst able to bring expertise and shape the

experience from within the institution (Proctor, 2010, 2013). The parallels with teachers in open plan learning spaces are explored in the context of each of the key insights.

Teacher curator and language to describe emergent practice

Images of teachers that expand or explain the role of teacher through metaphor or figurative devices is well known to education and form part of the broader narrative teachers form in establishing their professional identity (Bullough, 1991; Clandinin & Connelly, 1998). Images such as 'sage on the stage' or 'guide on the side' are well known in schools and in education literature (A. King, 1993). They offer a shorthand for how teachers ought to be; a heuristic of practice. Such images can serve as implicit models of self and practice (Bullough & Stokes, 1994; Clandinin & Connelly, 1996).

The general pattern of teacher images has seen a shift from models of knowledge transmission to knowledge construction; as in 'sage' to 'guide'. In parallel, the literature on innovative learning spaces reveals a desire to challenge the images of teachers based on authority and hierarchy (McGregor, 2004b). Spaces infused with power structures are seen as inappropriate given developments in educational research and practice (Aitkin, 2011; Blackmore et al., 2011 and others). The data revealed that emergent practices of pedagogy, and occupation of the spaces generally, demonstrate a trend toward that goal.

The image of teacher curator sits comfortably in the tradition of student-constructed or co-constructed knowledge. It allows for the agency of the student and the role of teacher as empowering this agency. It extends images like 'guide' by affirming the role of the teacher in establishing and monitoring the structures of the learning. The exhibition would not occur without the expertise and insights of the curator. Curator establishes an image that embraces the expertise of the teacher in establishing the experiential confines – space, artworks, mode of engagement – while understanding the reciprocal role of the student as crucial to the success of the endeavour – the exhibition in completed by the patron's engagement.

Relational agency and the teacher curator

The emergence of agency as critical to the successful iteration of quality teaching and learning in up-scaled open plan learning spaces provides a further reference against which to measure the teacher curator metaphor. Agency offers parallels and limitations for the relevance of the image. A general point is made that viewer agency is acknowledged and growing in presence in the world of curators and directors of public institutions such as galleries and museums (Proctor, 2010). A further parallel can be established between practice that has a joint focus and the coming together of curator and viewer. Emerging practice of curators as promoting and leading collaborations through social media and guided by public opinion is one example (Brooklyn Museum, 2015; Kelly, 2009). The act of a viewer engaging with an exhibit and constructing her own learning or interpretation offers meaningful links with the constructivist ideas underpinning practice in the open plan settings under scrutiny. The teacher curator is concerned with presenting opportunities for students to engage and construct meaning.

Relational agency focuses on object-oriented joint practice through fleeting micro-negotiations (A. Edwards, 2011). The finer theoretical details of relational agency reveal limitations in the metaphor. It is difficult to see a viewer/participant as involved with the curator in the same way as a teacher is in the learning process. The process of engaging with art is inherently more open than the curriculum-based engagement in schools. Nevertheless, where relational agency is understood to be the interactions between teachers on an artefact, or between teachers and students – expressed as mutual agency – the metaphor assumes a particular luminance. The teacher curator offers the character of the role of teacher in the open plan learning environments.

Embedded affordances and teacher curator

The importance of curriculum structures to practice in the up-scaled open plan settings provides particular congruity with the teacher curator metaphor. The necessity of structures and systems sitting behind an apparent and real openness of engagement

conforms to the idea of curator. The conceptualisation of embedded affordances, in particular, is harmonious with the metaphor.

The development of embedded affordances is context specific, educator-driven responses to the brute affordances of the space; the deliberate manipulation drawing on traditions of practice and established expertise is paralleled in the work of curators. The image arises out of and provides for the ongoing innovation of known forms. “As always, the creativity and vision of artists show museums how to think and work innovatively when applying new tools to old problems” (Proctor, 2013, p. 350).

Teacher curator: A final rendering

In this framework the teacher curator is purposefully shaping the teaching and learning experience through the careful construction of system overlays to achieve an open ended, mutually agentic engagement. The interpretation that is available to viewers of curated works may not be available in the education context in the purest sense, but this is a naturally occurring limit specific to the application of the metaphor. The strength lies in the equipping of teachers with a new vocabulary. The image sees their role affirmed in the development of local system responses while acknowledging the emerging emphasis on agentic teaching and learning. The adaptive, responsive teacher must be aware of the curated elements and the needs of the participant. Moreover, they must also be constantly reflecting on the various dimensions of their work and altering as determined as necessary. The image of the guide is no longer sufficient. The teacher curator provides the depth and scope to characterise practice in the open plan settings.

Chapter 7 Conclusion

Introduction

Bringing together the impetus of quality twenty-first century education and architectural principles to examine teacher practice

In this chapter the key research question, along with the four questions informing it, will be addressed. The Bendigo Education Plan saw the development of site-specific responses to a coherent town-wide strategy utilising built space to influence teaching and learning. Measured against a defined vision of quality teaching and learning the three case study sites presented emergent practices unified in their endeavour to maximise student learning in line with the intentions of the BEP. The particular school-based responses offered the opportunity to examine emerging teacher skills.

Each school in the study sought to respond to the conditions of emerging educational practices in the twenty-first century. The curriculum developments aimed at personalised, collaborative, stage-based, and ICT-rich teaching and learning. This is consistent with strategies identified at a system level within Australia and across the world. Likewise, the literature informing these developments focuses on the need for connection between education and the contemporary society into which the students will be thrust.

Educational and architectural literature has influenced the development of open plan learning spaces. A compelling argument is established challenging the dominant industrial model education system through the confluence of various research and societal developments: constructivist, student-oriented learning theory; the benefits of collaboration to teacher development and resource distribution; the increasing presence and performance of ICT, particularly features of Web 2.0. The role of physical space has also emerged as a dimension of the challenge to outflank any counter arguments. Architectural literature asserts the impact of built space upon behaviours as axiomatic.

Where the two literatures intersect, various gaps emerge. Notably, the limits to establishing links between built space and learning outcomes are well known to the literature. Likewise, detailed, close examinations of open plan settings are not a feature of the established research. A fine grain examination of the novel settings is provided in this study and reveals the role of educators in furnishing the architectural metaphors specific to the open plan settings. Further, in locating the educational influence the emergent practice can be examined in an educational context, not simply as an expression of architectural principles.

The emergent practices at each school site presented curriculum and pedagogical development as occurring on a spectrum of quality teaching and learning. This vision of quality involves agent-focused, personalised, collaborative, authentic, and ICT-rich learning. This vision is focused on the process or components of quality a teaching and learning as distinct from a catalogue of content or discipline preferences. Each site presented opportunities to examine responses at various phases. Matassa and Tellurian Secondary Colleges, in particular, offered the chance to examine programs adopting school-wide responses to the altered learning spaces and the twenty-first century context.

This study provides a fine-grain examination of open plan learning spaces. This occurs through the identification of enablers and constraints, the contribution of concepts of collaboration in traditional settings to those of open plan, and the examination of teacher expertise in the open plan learning environments. Further, the theoretical and practical implications of these findings are articulated.

Addressing the key research questions

The key research question of this study is:

- What are the sustainable or generative teacher skill sets in teaching and learning within open plan learning environments?

The central research question is informed by four further questions:

- What are enablers and constraints contributing to teaching and learning in open plan settings?
- What conceptions of collaboration in traditional settings contribute to our understanding of collaboration in open plan settings?
- What constitutes expertise for teachers in the open plan settings?
- What are the theoretical and practical implications of these findings?

The sustainable or generative teacher skill sets in teaching and learning within open plan learning environments examined in this study are outlined below.

What are the sustainable or generative teacher skill sets in teaching and learning within open plan learning environments?

This study forwards the requisite conditions of quality teaching and learning responding to the conditions of the twenty-first century: customised, student-oriented, collaborative, authentic, and ICT-rich. Within this frame the use of open plan learning spaces to affect curriculum structures were considered. Each school presented iterations occurring at various stages ranging from early to advance phase. Teacher skills were understood to be occurring within this spectrum.

Teacher skills are also considered as adapting from those consistent with a traditional setting. The move from single-teacher practice defined by discrete stand-alone space delineated by rigid organisation of time affirming the isolated practice was necessitated by the open plan learning settings. Nevertheless, the shift occurred in a saw tooth progression responding to the various demands and affordances provided by the phase of response within the open plan environment.

The advance phase responses amplified all elements of practice through careful construction of curriculum overlays designed to maximise student learning through the possibilities of the space aimed at quality teaching and learning.

Early to mid phase teacher skill sets

The early to mid phase responses were defined by initial adaptations requiring teachers to alter parts of their practice. Early to mid phase responses were observed to produce practice that was episodic, staccato, and irregular based on selective engagement with the offerings of partial alignment of curriculum. This in itself is enough to identify new teacher skills but is only part way toward the amplified practice in advance phase responses. Further, such instances informed the identification of the advance phase responses.

Teacher skills in the early phase are impacted by increased interactions with colleagues and students within highly scrutinised environments. The irregular progression of peers, especially in the early, voluntary stages, further emphasised flexibility. Early phase skill sets are identified as:

- Collaborative skills – interpersonal skills, communication and cooperation
- Comfort with scrutiny & accountability
- Flexibility of pedagogical beliefs and practice

Advance phase teacher skill sets

Practice within the advance phase occurred within embedded affordances. These structural features were simultaneously a response to the conditions and a further set of affordances. The advance phase saw an amplification of those impacts described as happening in the early phase. The aligned and synchronised curriculum structures meant the skills required were necessary, approaching non-negotiable status, for successful practice.

The addition of a curriculum overlay in the embedded affordances meant the adaptations of teachers became focused on serving the vision of teaching and learning. This saw a refocusing of thinking toward innovative use of resources through the shaping of time, space, and expertise. Teachers were required to understand and adapt

within the frame of this articulation of teaching and learning. Moreover, the defined focus of personalised, stage-based learning meant student agency was foremost in the minds of teachers.

The compulsory dimension to the advance phase saw collaboration amplified and the following features were identified as critical: collaborative practice, team orientation and adaptability. This gave emerging skills a particular orientation toward relational, intrapersonal dimensions. The advance phase skill sets are identified as:

- Adaptability of practice within teams and various sized groups geared toward achieving student agency;
- Team orientation: preferencing goals of team to those of self, adopting the sanctioned vision of teaching and learning;
- Reflexive practice: reflecting on individual and team practice (with specific goal of mutual agency).

The embedded affordances – the school-wide response – dictate the finer points and suggest a team orientation in vision of teaching and learning at the very least. The particular employment of space, time and resources to maximise a personalised curriculum resulted in collective practice requiring acute adaptability of practice along with skills in considering practice in situ and longer term as individuals and as a team.

What are enablers and constraints contributing to teaching and learning in open plan settings?

This study asserts that key enabling and constraining constructs of open plan spaces are identified as occurring in the mix of brute-space and refined educational responses involving an articulation of teaching and learning. Together, these presented a set of embedded affordances within which programs could be refined and teacher practice could be honed.

The open plan spaces presented architectural ideas of flexibility and openness to teachers and school leaders. The brute space was generally understood as enabling by

way of greater practice options. The occupation of the spaces in all phases of response was testament to the intentions of flexibility as articulated in architectural ideas and broad educational justification of the spaces. Teachers were called on to respond to vastly altered conditions taking in up-scaled public practice.

Those instances of practice occurring outside of the embedded affordances still offered some enablers but were also found to present constraints. Where non-aligned teaching occurred within an open plan space teachers were constrained by levels of noise, distractions and student demands. Maintaining a predictable pattern of practice in such a situation led to the design of an ideal lesson at two of the school sites.

A further constraint was noted in teacher behaviour that sought to anticipate possible unfavourable alignment of classes with the intention and result of removing their class to another space. It is noted that this may be read as behaviour indicating skills of teacher flexibility but it is still ultimately a constraint of the open plan space.

The embedded affordances found in the curriculum overlay in the advance phase presented enabling constructs capable of progressing the engagement beyond the vague and empty architectural metaphors of openness and flexibility. The embedded affordances were centralised curriculum structures focused on maximising available resources with the goal of customised, stage-based, ICT-rich learning. The structures of embedded affordances sought to productively constrain practice within the open plan school environment.

Within the embedded affordances the significant enablers were the arrangement of synchronised curriculum and aligned classes. This allowed for the distribution of teacher expertise across a larger number of students. It meant a more strategic deployment of expertise as a resource in service of differentiation. It enabled teachers to develop resources and strategies of progress specific to their professional experience. The alignment also meant development of ICT resources served a significant group of teachers and students. These constructs were further enabled by the joint teaching that saw up to four teachers negotiating student learning in an open plan

space. Teachers regularly drew on the collected expertise in the room. The structures of the embedded affordances allowed the expertise to reach beyond a single teacher and a single setting.

Central to the embedded affordances was the up-scaling of classes. This enabled student agency by way of control over the use of space and engagement with teacher expertise and peers. The monitoring of the above, along with the negotiation of assessment tasks and self-paced stage-based curriculum meant teachers were regularly engaged in mutually agentic tasks with students.

What conceptions of collaboration in traditional settings contribute to our understanding of collaboration and leadership in open plan settings?

Where teaching is understood as a collective endeavour taking place in learning communities the emphasis on collaborative practice is affirmed. Collaboration is understood as mutuality and distributed intelligence. The up-scaled, open plan learning environments present an amplified and intensified experience of collaboration.

This study observed collaboration through substantially increased interactions between teachers as well as teachers and students. The interactions took place in formal and informal scenarios taking in almost all parts of the space and at all times of the day. Teachers were called on to negotiate with students during formal teaching moments but were often required to monitor the activities of students during periods of time they were not formally scheduled to teach and through social time such as before school or during lunch breaks. This impacted the learning space contributing to a general feeling of informality and de-emphasising traditional notions of authority and hierarchy. The feeling of informality and changed power dynamics resulted in an intensified collaborative environment for teachers.

The advance phase responses saw the focus of collaboration turn to pedagogical concerns. Where early phase responses were notable for the emphasis on adjusting to the new informal tone of the 'community', the near constant interactions, and establishing shared-space teaching protocols, the advance phase responses were able

to navigate collaborative practice in service of the goal of quality teaching and learning. This allowed teachers to frame their practice against an established and sanctioned idea. It did little to lessen the intensity of the environment but it meant that collaborations assumed a particular character focused on learning.

Relational Agency as a theoretical and practical frame for emerging practice

Relational agency is used to read the collaborative work and lends a vocabulary to the emerging practice. The collaboration occurs in preparation, implementation, marking and reporting. The interactions between teachers *in situ* saw the collaboration mediated by negotiation of resources or artefacts. This meant teachers saw themselves as part of broader team focused on student learning. The expertise at their disposal was the expertise of the team. The moments of collaboration were often fleeting but understood as critical.

The continuous monitoring and assessment of personalised, point-of-need joint teaching occurring in open plan environments saw relational agency extended through reflexive monitoring to mutual agency. Mutual agency is extended to teachers and students with shared focus on the artefact of learning involving reflexive monitoring of the practice.

Relational agency: Distributed intelligence and expanded spheres of teacher influence

The idea of distributed intelligence further shapes the findings of this study. This study found that teachers working in the advance phase responses in highly collaborative, jointly focused teams experienced an expansion of their influence. Where colleagues became resources contributing to student learning, a teacher could contribute to the learning of students beyond a traditional idea of influence. Creating video resources, for instance, saw a single teacher's influence expand across all mathematics classes. Likewise, a particular expertise in middle years learning allowed the expertise to reach beyond a discrete cohort of students.

Relational agency: Intensified collaboration

Collaboration in open plan settings was intensified and amplified. The work required a team orientation, collective responsiveness, as well as reflective monitoring of one's own work and that of the team. Further, it necessitated an understanding of agency that was relational and mutual, as distinct from singular or isolated. The collaborative environments also saw an overlap and expansion of an individual's sphere of influence.

An account of teacher expertise in open plan settings?

This study asserts that expertise in the open plan settings is necessarily adaptive and relational. The vastly altered circumstances from traditional school settings impact both the beliefs and practice of teachers. Existing models of teacher expertise provide a significant lead on the emerging expertise in the unique environments. The work of teachers in the advance phase responses in particular informs the response to this question and can extend the models through a detailed account of successful practice.

Teachers were required to adapt to changing expectations of teaching and learning. This constituted a review of beliefs about teaching that was a response to the public practice necessitated by the brute space, as well as the centralised philosophy established as part of the embedded affordances. This meant reviewing one's own beliefs and working within a mandated approach that may not have aligned with existing beliefs.

Team based, joint-focused practice in the up-scaled advance phase iterations necessitated a response to permeable or fluid learning arrangements and individualised, largely unmapped and therefore unpredictable learning moments. In these scenarios teachers were required to be agile and fleet footed practitioners aware of individual needs, progression trajectories, discipline knowledge and familiarity with activities. Further, teachers had to be able to read the dynamics of large groups, small groups and individual interactions across vast spaces taking in the presence of other professionals.

The complex practice arrangements in novel settings produced emergent practices. Adaptive expertise focuses on the negotiation of routine efficiency and innovation (Schwartz et al., 2005; Sternberg & Horvath, 1995). Adaptive expertise was present as teachers drew from existing skills and responded to the unique circumstances of altered physical setting and altered curriculum structures.

Relational expertise emerged as a feature of teacher expertise in the highly collaborative learning settings. The ongoing occupation involved negotiation of resources and responses to student need in formal and informal moments. The frequency of the interactions and team-based nature of the work meant peer collaborations were a necessary feature. The joint-teaching frequently resulted in unscripted collaborations. The collaborative work of teachers is further aligned with the model of relational expertise that focuses on knowledge traversing workplaces and linking individual practitioners through common knowledge.

The broad currents of teacher expertise shifting from content to pedagogical expertise is reflected in the expertise required in open plan settings. The presence of adaptive expertise that is at once relational and responsive is testament to the shift noted in the literature. In particular, this study forwards the use of a prototype model of expertise as suited to the setting where teacher expertise is considered emergent. The core features of the prototype model are apparent in the advance phase response: knowledge, efficiency, and insight (Sternberg & Horvath, 1995).

What are the theoretical and practical implications of these findings?

This study contributes to theoretical considerations of teacher adaptation along with the practical modes of assessment of the open plan spaces. Teacher adaptation is advanced through the addition of a dimension of graduated phases moving through a saw tooth progression away from existing knowledge toward new practices. Assessment of open spaces is understood to require a reading of the setting that takes in both the brute space and the iteration of curriculum occurring within it.

This study posits three critical insights of teacher adaptation specific to the open plan settings: limited language for describing emerging engagement; increased and intensified collaboration is necessary; and the embedded affordances are a central factor in reading teacher adaptation. As teachers attempt innovation they are drawing on existing practical and theoretical knowledge. Nevertheless, new pedagogies and modes of professional practice require a language that is still being formulated. Adaptation in advance phase open plan spaces takes place in dynamic collaborative teams where the bounds of individual agency and influence are not clearly defined. Finally, the attempt at productive constraints through the introduction of curriculum overlays further shapes the potential adaptation through enablers and constraints.

This study forwards the insight that theorising on teacher adaptation in open plan spaces ought to consider the mix of efficiency and routine with innovation as occurring within the bounds of a developing language and a newly collaborative practice. Further, the embedded affordances impact the potential changes to teacher practice in constraining and productive ways. Leaders must consider this suite of factors when aiming for goals of disruption to existing practices in schools. Moreover, the intentions of the broader program of innovation must also be aware of the dynamic components present in the open plan spaces.

This study proposes that assessments of the spaces occurring in the advance phase must assume an educational focus. Where existing models of assessment do not extend beyond the influence of brute factors such as lighting or temperature, a new model must be a response to the emerging educational picture. This is achieved by measuring success against site-specific curriculum overlays. The identification of embedded affordances allows a meaningful measure of practice to occur. Such an approach is an examination of both intentions and practice with the scope to detect vague or empty statements of innovation in planning or implementation. In this way the factors impacting teacher practice are taken to be both administrative and practice based.

Reflective analysis on the theory

This study proposes an extension of the key theoretical frames of agency within structuration theory and the theory of affordances. Both provided theoretical orientation for the reading of open plan learning environments. In each case a further extension of the theory is identified as warranted specific to the context under scrutiny. Structuration and relational agency combine in the highly complex collaborative work environment to form mutual agency, found primarily in advance phase responses and made critical in the heat of practice. Affordance theory is extended in line with school-based readings of agency within institutions to be refined as *embedded affordances*.

Combined with the reflexive monitoring of emerging practice centred on student learning, relational agency assumed a dimension of mutuality. This advance on relational agency sees the central work of practitioners consumed by a joint focus on the artefact. This is different to the fleeting light touches described in relational agency. The focus on the artefact through joint practice sees the relational agency folded into an ongoing, shared, mutual enterprise united by student learning. This recasting of agency is an advance on relational agency found in intensely collaborative teaching and learning environments concerned with amplifying student agency through personalisation.

This study proposes a contextualised extension of affordance theory. Where the broad features of the theory served to orient the reading of brute space, a refinement was required to capture the impact of the curriculum overlay. Each school shared similar goals of student centred learning and executed these to varying degrees. The advance phase responses implemented a curriculum overlay that was captured by the concept of embedded affordances. These were inserted or imposed on the site in a reaction to the affordances of the brute space and the needs of the curriculum. Moreover, they sought to deliberately promote certain modes of engagement by teachers and students. Teachers and students were then required to respond to a further set of affordances. Embedded affordances are offered as an extension of the

theory with specific intention of reading the open plan learning spaces. Such a theoretical tool may be further developed in assessing open plan schools.

Implications

The insights generated by this study have relevance for several stakeholders engaged in education. As education systems engage with open plan spaces the findings based on the lived experience is important in informing the work of teachers and school leaders; parent expectations and student skills; constructing policy responses, and teacher education. The following section outlines the various implications for each of the groups for whom dissemination of findings would be beneficial.

Implications for teachers and leaders in open plan schools

The insights of this study present a set of implications for teachers and leaders in open plan schools centred on the mode of engagement, and the desire to engage with the possibilities of the open plan setting. The development of strategies for schools occupying open plan schools ought to be underpinned by a vision of quality teaching and learning. This study established a clear relationship between the curriculum overlay and the productive engagement of the spaces. Schools hoping to harness the potential of the spaces ought first to consider the version of teaching that is made possible by the open plan setting and that aligns with their desires for their students. Traditional practice in open plan settings, even alongside innovative practice, can activate the constraints of openness as easily as it triggers the enablers.

The work of teachers is profoundly altered by the up-scaled open plan settings engaged in maximising student agency through personalised learning in line with the twenty-first century interpretation of quality. The teacher curator metaphor goes some way toward capturing the work of teachers in the novel settings. The sage is jettisoned with the removal of the stage. The guide on the side is no longer sufficient for the presence of the growing agency of the student and the invested agency of the multiple teachers engaged in achieving learning. The teacher curator must be engaged with the learning project and capable of responding to feedback. The teacher curator is simultaneously a guardian, an agent, promoter and guide; a cataloger and spruiker

enthusiastic about learning and personal interest. The teacher curator can accept multiple versions of engagement and be comfortable with the presence of other curators who may know more and offer expertise that she doesn't have. At times, the curator will know less than the audience/viewer.

Implications for parents

Implications for parents centre on the emerging practice of teaching and learning recognised as altered from traditional modes. The idea of what learning looks like is changing. The once stable image of a student with her head in a book is giving way to multi-modal engagement that may not be recognisable to parents. The skills that students require to succeed in advance phase, agentic learning environments are a clear extension of the skills needed for traditional bookwork. The work students 'carry home' looks vastly different to work of only a few years ago. Indeed, it looks different to the work they still take home from other classes. The advance program in open plan spaces may challenge parent expectations of learning and teaching. An attempt at informing parents of the altered conditions of the learning and the expectations of student behaviour may alleviate any anxiety or misunderstanding.

Implications for policy writers and administrators

The implications for policy writing and school or system level administration are based on the following insights: the critical nature of embedded affordances, and the emerging importance of agency.

Embedded affordances were the school level response to the affordances of brute space. The curriculum structures provided an educational layer to the initial promise of openness and flexibility. The practical expression of these ideas often saw *ad hoc* responses carrying as many constraints as they did enablers. The positively framed openness contained a symbiotic liability in noise and distraction. The introduction of a curriculum overlay provided an educational rendering to the openness. It was at this point that student learning could be maximised and the manipulation of time and space could be geared toward harnessing the resources available. Further, the distribution of

resources across a larger number of students made the structure more effective. The sphere of influence for individual expertise was amplified. More could be done to serve a greater number of students with a finite set of resources.

This study provided further insight to the practical nature of twenty-first century teaching and learning in open plan spaces. The combination of agentic, personalised, authentic, student-driven learning is enhanced by the agency affirming occupation of the open spaces. Student-oriented curriculum is supported by spaces offering student control over mode and pace of engagement through the response to the space and the resources within it. When personalised learning occurs as a curriculum overlay utilising the possibilities of open plan spaces the agency of students and teachers emerges as a practical consideration.

The full consequences of this development are not explored in this study. However, the development of pedagogies capable of harnessing this approach will rely on ongoing refinement of curriculum overlays and the understanding of teacher expertise as adaptive and relational. The use of theoretical constructs such as mutual agency and embedded affordances can assist in shaping and assessing this ongoing work.

Implications for teacher educators

A new set of conditions are emerging as important considerations for teacher educators. Graduate teachers in Australia are likely to encounter open plan spaces on the back of the building programs that favour open plan approaches. Indeed, the innovative building approach may have slowed in the UK, but it remains a priority for organisations such as OECD and is still considered important in many Western systems. The reach of the implications is significant.

This research presents an emergent skill set that must be a consideration for effective teacher training. A greater focus on teacher expertise taking in affective dimensions such as intra and inter-personal knowledge needs to occur to support the

emergence of increased collaboration. A further examination of teacher beliefs and strategies for exploring these should also feature in training programs.

On a practical level student teachers ought to experience working in close-knit teams where individual agency is extended and the resources of others are considered essential parts of the greater whole. Likewise, giving over of the self, of 'letting go', 'jumping in', and 'taking risks' through broad pedagogical knowledge and practical agility requires practice in preparing for the advance phase open learning spaces.

Implications for future research

Future research of open plan spaces offer an opportunity to extend the scope or further focus the examination of the insights of this study. An examination of the insights across a larger number of sites offers scope to affirm or challenge the findings and conclusions, especially in relation to the importance of curriculum overlays and teacher skills. This approach would require the development of a new tool for conducting the research across large data sets with the potential to capture whole systems.

Extending the depth of the study through detailed case studies would allow for the examination of discipline specific insights. It would allow for the development of a fine grain picture with a sharper focus on impacts on individuals. Further, individual responses could be identified with the potential to generate insights specific to theoretical underpinnings such as adaptive expertise, agency or affordances.

The model used in this study contributes to the ongoing refining of methods for assessing open plan spaces. Where new models emerge as a result of the convergence of current research, this study can contribute the key insights of the critical nature of the embedded affordances, as well as making links between teacher practice and goals of personalised twenty-first century learning.

Limitations of this study

It is acknowledged that the qualitative research carries limitations but rigorous attempts have been made to counter these. The critique of case studies often focuses on lack of generalisability (Silverman, 2007; Yin, 2014). This was countered with the use of multiple case study design achieving generalisations with robust theoretical foundations (Alasuutari, 1995). The case study method offers an in-depth or thick explanation of the real-life situation (Cohen et al., 2011; Rudestam & Newton, 2014). The generation of practical and theoretical insights, along with the potential for the extension of the insights through continued research further justifies the case study approach.

The case study sample size is noted as a limitation on this study. The focus on a selective sample of teams is justified as a means of establishing insights in the novel settings at the early stage of engagement. The limitations of this approach are acknowledged as part of the methodology. The insights of the study are offered as qualified generalisations requiring further examination via carefully constructed tools to verify applicability across settings or contexts.

Final thoughts

This study highlighted the intense, complex and fluid settings of open plan learning spaces. The extent of the complexity revealed a degree of teacher adaptation not required in other settings. The embedded affordances created by systems and schools responding to the possibilities of open spaces established a situation where adaptations were encouraged and required. The necessity of adaptation is emerging as a feature of the open plan spaces. The critical and ongoing need for adaptation established a set of conditions amplifying teacher skills hitherto understood as preferable but not necessary. The impact of this situation is revealed as encompassing practice, knowledge and understandings of epistemological reasoning. Coupled with necessary adaptation is the highly collaborative practice of aligned teams. Teachers must adapt in response to and as part of tight-knit professional teams conducting all

elements of practice. The study focused on the amplified conditions created by settings seeking to establish twenty-first century learning experiences. The role of the teacher is similarly amplified and a new set of demands in line with the twenty-first century context is emerging.

The work of teachers in the open plan spaces has revealed the need for new images to represent the work of teachers and new language to describe the complex and interrelated task of establishing teaching and learning befitting a vision of quality in the twenty-first century. The isolation inherent in many education structures, both physical and institutional, is disrupted and challenged in the new settings. The potential to achieve agency of teachers and students is increased and the pressures of a flattened hierarchy amongst teachers and between teachers and students is part of the ongoing life of the setting. Teacher skills are increasingly focused on adaptation and collaboration. The embedded structures found in open plan schools and broader system increase demands on teachers to develop skills of adaptation and collaboration. The meaningful alignment of classes, resources and personnel must become features of the open plan scenario to ensure teachers have the opportunity to develop the skills required in the open plan learning environments.

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