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Teacher data agency and the mediation of new ways of knowing in schools:

A socio-cultural perspective of professional learning, relationships and educational change

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Abstract

This research considers the growing significance of data in educational systems. While data use in schools is not a new phenomenon, the collective emphasis on evidence-based decision-making in education draws attention to the purposes and effects of data use and the impact of new ways of knowing in schools. This thesis seeks to understand the conditions that drive these evolving data use policies and interventions and the tensions that emerge from a dual focus on data for school improvement and accountability policies as enacted in schools. The research explores the complex relationships between structure, culture and agency in the context of reform and organisational change in an Australian state-based education system.

Drawing on a critical realist philosophical position which underpins the subsequent social realist research, this thesis is concerned with making the connection between social ontology and practical social theorising to consider the ontological and epistemological status of data in education and the impact of the rise of data in schools. Margaret Archer's explanatory methodology, the morphogenetic approach, supports an analytic separation of structure, culture, and agency, which reveals the complex interplay between social practices that accompany data use in each setting.

The research involves a qualitative multiple-site case study of four state primary schools located in the south-east corner of Queensland, Australia at a time of continuing educational reform. The schools, two from the state capital city and two from the 'bush' (rural sites) were subject to the same policies and procedures and funding arrangements as implemented and overseen by the state governing body, Education Queensland. An initial analysis revealed co-occurring yet contested structural and cultural conditions driving data use in schools. Agent interaction with and within these contexts was likely to generate alternative emergent structural conditions than otherwise anticipated.

Working retroductively, the research developed a broader perspective of the research phenomenon that commenced at an infrastructural system level and finished at an individual agent level. This stratified representation sought to explain/expose the accumulated sense of constraints and enablements, structural and cultural that are imposed on differently situated agents and actors across contextual strata by the rise of data in education systems. The final cross-case comparison revealed a set of generative mechanisms occurring in the context of principal/teacher professionalism that operated to either enable or constrain teacher data agency. Consequently, the research contributes to the mounting debate that surrounds the effects of intensified data use in schools. More specifically, it examines the emerging social relations in terms of their relations of power and control and their

potential to alter conditions of performance and teacher agency. Furthermore, the study traces the causal pathways between the contested knowledge bases of school improvement and accountability and the resultant individual and collective emergent agent action.

This macro, meso and micro analysis of emergent effects of data use in schools presents opportunities to contribute on several educational fronts, foremost as a granular analysis that identifies the generative mechanisms that shape the outcomes of school improvement and accountability policies. In addition, the research provides insights into school reform efforts through its attention to external and internal forms of school improvement and accountability and the resultant agential action. The analysis outcomes consider the necessary social relations between administration, leadership teams and teachers required to afford an extended form of data professionalism and improved teacher data capacity. In short, teacher data agency might be possible in circumstances that trigger professionalism and a sense of professional identity through transparent data interactions and respectful relationships that value teacher insight and knowledge. Teacher agency is less likely when these data-driven interactions are characterised by target-setting and surveillance practices that re-shape the teacher in their role as a professional and can shift the teaching and learning focus away from other critical educative practices.

Finally, this research, with its focus on critical realism underlabouring and Archer's social realist theorising contributes to the current debates informing data use in schools in at least two ways. Critical realism offers alternative ways to 'see' and 'know' the world within a stratified reality, in turn affording the opportunity to examine the rise of data use in novel and interesting ways. In addition, the morphogenetic approach with its concern for understanding the possibilities of change over time through socio-cultural interaction provides a research strategy that links social theory with practical research outcomes. Noted also within the research are the challenges and limitations of a critical realist approach. Lastly, the research suggests that a critical realist vehicle supports the interdisciplinary approach currently being called for to further examine data use in educational systems.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

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No publications included.

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<u>Contributions by others to the thesis</u>

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Statement of parts of the thesis submitted to qualify for the award of another degree

No works submitted towards another degree have been included in this thesis.

Research Involving Human or Animal Subjects

This study was approved by The University of Queensland, School of Education Ethical Review Committee (approval no: 14-028B).

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framework, are now part of us. Your role as a sounding board and chief cook, bottlewasher and personal shopper are noted and appreciated. I think it might be your turn now.

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Keywords

critical realism, social realism, teachers, data, structure, culture, agency, school improvement, accountability

Australian and New Zealand Standard Research Classifications (ANZSRC)

Provide data that links your thesis to the disciplines and discipline clusters in the Federal Government's Excellence in Research for Australia (ERA) initiative.

ANZSRC code: 130304 Educational Administration, Management and Leadership 33.3%

ANZSRC code: 160506 Educational Policy 33.3%

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Fields of Research (FoR) Classification

Allows for categorisation of the thesis according to the field of research.

FoR code: 1303 Specialist Studies in Education 33.3%

FoR code: 1605 Policy and Administration 33.3%

FoR code: 1608 Sociology of Education 33.3%

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List of Abbreviations

ACARA	Australian Curriculum, Assessment and Reporting Authority
ACER	Australian Council of Education Research
AITSL	Australian Institute for Teaching and School Leadership
ARD-SP	Assistant Regional Director – School Performance
BoSS	Botanica State School (case study school)
BrSS	Brushbox State School (case study school)
COAG	Council of Australian Governments
CoSS	Corymbia State School (case study school)
CR	Critical Realism
DET, Queensland	Department of Education and Training (Queensland, 2009)
DETE	Department of Education, Training and Employment
EQ	Education Queensland
ICSEA	Index of Community Socio-Educational Advantage
MT	Master Teacher
NAPLAN	National Assessment Plan – Literacy and Numeracy
OECD	Organisation for Economic Co-operation and Development
PISA	Program for International Student Assessment
QCAR	Queensland Curriculum, Assessment and Reporting Framework
QTU	Queensland Teachers' Union
TIMSS	Trends in International Mathematics and Science Study
WaSS	Waterhousia State School (case study school)

Glossary of Terms

Abduction – "Inference or thought operation, a cognitive process, implying that a particular phenomenon or event is interpreted from a set of general ideas or concepts" (Danermark, Ekström, Jakobsen, & Karlsson, 2002, p. 205; Hartwig, 2007).

Abstraction – "The outcome of a thought operation whereby a certain aspect of a concrete object is isolated" (Danermark et al., 2002, p.205). This process was used to isolate structural properties and relations within each case.

Agency - Archer's (1995) definition of agency asserts that efficient/mediating cause of elaboration or change, as such, it is does not make sense unless reference is made to both the structural and cultural contexts in which agency is operating.

Agent - Is a human who acts within a social and cultural structure. Archer (1995) proposes a model that stratifies agents and agency.

Analytical dualism - A development of the transformational model where a time dimension is included (Danermark et al., 2002), Archer developed the morphogenetic approach from this idea. A consequence of analytic dualism is the identification of structural, cultural and agential properties and to analyse their respective influences and interaction (Archer, 1995).

Causality - Causes and effects—most basically the power to bring about change (Hartwig, 2007). For critical realism it is the nature of the object and how it is viewed that determines what it can and cannot do (Danermark et al., 2002).

Concretisation - Part of an explanatory model of social science, examining how "structures that have been described in an abstract, isolated form, manifest themselves in concrete cases, in historical, social and cultural contexts" (Danermark et al., 2002, p. 205).

Context-mechanism-outcome configurations - Configurations used in realist enquiry developed by Pawson and Tilley (1997) to describe what aspects of an intervention (policy reform, school improvement program) work for whom, why and in what circumstances.

Culture - In CR terms, culture is seen to be a complex term. The CR stance situates culture as the development of thought and expression, involving structures, practices and products that are socially embodied (Hartwig, 2007). Culture is also seen to have links with other social structures however it has its own characteristics that make it irreducible to those other structures (Archer, 1995, 1996).

Emergence - The appearance of something new, that while being dependent on that something other, is irreducible to that other.

Epistemic fallacy - "The analysis or definition of statements about being in terms of statements about our knowledge (of being)" (Bhaskar, 1993, p. 397) or more simply "reducing

reality to empirical observations, that is, apprehending and defining reality as being identical with empirically grounded conceptions" (Danermark et al., 2002, p. 205).

Generative mechanisms - A series of components that may form a causal configuration (Fleetwood, 2004) or more simply what makes something happen in the world, something that has the power to change something. In realist enquiry the explanation for mechanisms lie in how an agent reasons their way to a decision.

Intransitive/transitive dimensions – "The intransitive dimension is the object of scientific knowledge, but it can be extended to comprising all that exists, which is the ontological side" (Danermark et al. 2002, p.206). The transitive dimension is our conceptions of what exists (people and their beliefs), the epistemological side (Bhaskar, Danermark, & Price, 2017; Danermark et al., 2002). There can be an element of unreliability in our knowledge of the transitive and intransitive dimensions.

Morphogenetic approach - "The identification and temporal mapping of relations between social and cultural structures via or through descriptions of social and socio-cultural agential interaction" (Lipscomb, 2014, p. 41). These maps can provide evidence of transformation (morphogenesis) or reproduction (morphostasis).

Morphogenesis - Transformation as a result of social and socio-cultural interaction at a structural and cultural level.

Morphostasis - Reproduction as a result of social and socio-cultural interaction at a structural and cultural level.

Retroduction – is a form of inference of explaining by recognising and confirming the existence of a set of mechanisms theorised to have produced the phenomena under study (Wynn & Williams, 2012). Retroduction is a key strategy used by critical realists to make empirical knowledge claims.

Social actor - In social realism, a social actor is an individual able to inhabit a social role in a distinct way (Case, 2013).

Stratified ontology - In CR, reality is considered to be stratified and made up of structures, mechanisms, events, and experiences (Bhaskar, 1979).

Structure - A set of internally related objects. Here the structure of a thing is instituted by its causal powers (Bhaskar, 1993).

Underlabouring - Bhaskar conceived of critical realism as an underlabourer to the sciences/social sciences, the aim to produce indirect or second order knowledge and develop ways of thinking that might clarify and refine questions of methodology (Joseph, 2002).

1. Introduction

1.1 A Personal Note

This study arises from my experiences within the education sector both in Australia and Papua New Guinea (PNG). I began teaching in a small international school in PNG in 2005. Tanui International School (TIS) was part of a group of 20 schools administrated by the International Education Agency of PNG (IEA). The administration of the IEA recruited educators from across the globe; however, the core came from England, Canada and Australia, the latter country providing most of the teachers and almost all the entire curriculum, while the former two provided advisors and the policy frameworks for many of the school improvement and accountability processes. While Australian education systems, more specifically from a state level, were most influential in terms of curriculum and day-to-day administration, the school inspection regimes, teacher professional development and performance review processes from the UK and Canada formed the hybrid processes implemented in the schools in 2004.

Some of the effects of these performance technologies on teachers specifically and on schools in general, were apparent to me when the school where I was teaching was subject to the top-down school review process. This entailed an initial school-based self-evaluation program followed by a three-day school inspection carried out by an external expert review panel. In the stressful weeks leading up to the review, the teachers were involved in the construction of what Ball has called 'fabrications', representations of the school organisation that best fitted the version of the school that was most 'privileged' by the policy drivers (2003, p. 224). The school was being prepared 'to be accountable' to an external audit process, and these 'fabrications' were a direct response to pressure to present data in a particular way. In this respect, teachers had to operate within two structures or contexts—a school improvement perspective alongside one that was designed to ensure that the school remained accountable to external influences.

Following this initial first-hand experience of the effects of audit processes, I was involved in a state-wide evaluation of the implementation of the Queensland Curriculum, Assessment and Reporting Framework (QCAR) carried out by The University of Queensland in 2010-2011 (Mills et al., 2012). While the focus of that research was the implementation of QCAR, data were also gathered about other state and federal initiatives, including the effects of an external audit process known as the Teaching and Learning Audits. During the 82 principal phone interviews I conducted, I became intrigued by the range of responses to the Teaching and Learning Audits which positioned

the process as both an enabler of school improvement and a summative evaluation process. Why this ambivalence? What was it about this process that engendered such a variation in reactions?

The concurrent rise of data use for school improvement and accountability is the companion piece to these anecdotes. While data informed both the school review and audit processes in their early forms, it has been the technological advances in infrastructure and the sheer availability of data that have been most telling in the implementation of school improvement and accountability policies and practice in recent times. It is these experiences and others that have inspired this doctoral research project investigating the effects of the rise of data use and externally imposed school improvement and accountabilities processes on state schools in Queensland.

1.2 **Introduction**

This research explores the complex relationships between structure (systems, institutions, roles, positions, culture (theories, ideas, beliefs and values) and agency (organised groups, actors and agents) in the context of the rise of data use and organisational change in an Australian state-based education system. In doing so, it recognises the methodological challenges of researching in open education systems and the complex nature of the phenomenon. From this perspective, the thesis is both a sense-making and reflection exercise which sought to find explanation into why things were the way they were in different contexts. Accordingly, it examined the implications of contested knowledge bases - school improvement and accountability alongside the rapid rise of data in educational settings and the consequences of this for teachers and principals.

The research involved a multiple-site case study of four schools located in the South-East corner of Queensland. The schools, two from the state capital and two from the 'bush' (rural sites) provided state-based primary education to students aged from Prep to Year 7 (5 to 12 years old). Brushbox, Corymbia, Botanica and Waterhousia[1] State Schools' enrolments were characterised by diversity dependent on location and cohort. The rural schools had relatively small enrolments (30+ and 80+) compared to their city counterparts (600+ and 800+), respectively. Each state school was subject to the same policies and procedures and funding arrangements as implemented and overseen by the state governing body, Education Queensland.

At the time of the research, data use had assumed a critical importance in the quest for school improvement in Australian education systems. The significant role that data played in Queensland state schools' "explicit school improvement agenda" is noted in the inclusion of *the*

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[1] Pseudonyms all drawn from native Australian trees.

analysis and discussion of data as one of nine key dimensions of the current school review processes. In addition, the *Australian Professional Standards for Teachers* (AITSL, 2011) describes what teachers were required to know and do across four stages of their career. Standard 5.4, *Interpret student data,* details the level of teacher capability and proficiency from novice to highly accomplished that teachers were expected to achieve in their interaction with data (SIU, 2016). Furthermore, the Queensland School Improvement Unit Annual report of 2015 noted "As Queensland state schools continue to effectively plan, build capacity in their staff, and use data to inform their decision making, improvement logically follows (SIU, p.9). Accordingly, both government-mandated policy reform and regulatory bodies were driving a school improvement and accountability agenda predicated on the significant role data use played in the improvement of student learning outcomes.

This persistent focus on data achievement had its partial origins in Queensland's comparatively poor performance in NAPLAN (National Assessment Plan-Literacy and Numeracy) in previous years. Here a comparative space for commensurate measurement had been created in the form of a national standardised literacy and numeracy testing regime (Lingard and Sellar, 2013). The result in Queensland was the intensification of audit processes, the formation of a centralised school improvement unit, the creation of data targets and expectations, and the instigation of a further layer of principal management at a regional level. While other states were subject to the same national testing and audit cultures, Queensland's response was particularly noteworthy as a demonstration of the effects of "catalyst data", performance data that caused stakeholders to further interrogate results and seek change (Lingard and Sellar, 2013, p.635). Correspondingly, the continued focus on school improvement and data accountability intensified the educational policy and reform agenda across several educational levels in the Queensland state school context.

Accordingly, there appeared to be a valid claim that school agential interactions took place in similar base-line contexts across the school sites. What was clear was that the outcomes in each case site were seemingly quite different. In response to this contrast, this research employed a different theoretical stance. Here it is argued that any focus on the effects of new uses of data in schools requires a broader understanding of the wider context in which these interactions take place (Case, 2013). In this respect, schools were located within an inclusive framework of ever-expanding units, each of which has a stake in shaping the work of schools (Sellar, 2017). Additionally, teachers were located in classrooms and schools, which were in turn situated in regional systems. In Australia, these regions are located in state educational systems, which are then further influenced by a federal system and finally at a level which positions education as a global space (Sellar, 2017). This perspective recognises that any form of policy implementation shapes individual and collective

action within a wider context. Accordingly, any questions associated with data policy implementation must begin with the relationship between structure and agency (Coburn, 2016).

Archer (1995, 1996, 2000) argues that structure, agency and culture are separate entities analytically distinguishable across time and context. In this respect, structure has to do with both material goods and the domain of social positions and roles. Culture is situated in the world of ideas and how we think of ourselves, and agency is the space of human decision and action (Case, 2013). Here the freedom to choose is positioned against constraint by social forms (Scott, 2000). This structure-agency dynamic is extended further by considering the culture-agency interrelationships in the same way. Accordingly, "structure, culture and agency are considered three distinct ontological features of social reality" which despite being intertwined empirically can be sorted out analytically with the morphogenetic approach (Porpora, 2016, p. viii). As an analytical framework which examines human relations and interactions in context over time, the morphogenetic approach appears purpose-built for examining change in education systems.[2] Morphogenesis refers to change in the 'shape' of things, in this case, change (or transformation) of structure, culture and agency (Archer, 1995). Morphostasis is where no change happens, and things remain the same (they are reproduced).

Schools are embedded in a series of complex structural layers and each is likely to have in place further cultural arrangements, each layer with the potential to enable or constrain the actions of teachers within. Accordingly, teachers going to school each day enter a world that has been structurally and culturally influenced by a previous set of social interactions. It is a space not of their making, yet they have the potential agency to mediate the conditions in which they find themselves. Therefore, the empirical work was about finding explanatory purchase in how new uses of data and the associated paradigms were likely to influence conditions across these complex contextual layers.

For these reasons, Archer's (1995) realist social theory, supported by the philosophical underlabouring furnished by critical realism (CR) materialised at an opportune moment in the research process. Here, CR underlabouring performs a vital role, 'clearing' the ideological ground, producing second-order knowledge and clarifying questions of methodology (Bhaskar, 1989b), yet CR "… is not a philosophical free lunch. It makes you do things in a particular way" (Archer, Sharp, Stones, & Woodiwiss, 1999, p. 16) or perhaps more specifically it makes you do and see things in a specific way. Therefore, a significant part of this research project dwells on the 'doing'

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[2] Margaret Archer's early work includes Social Origins of Education Systems (1984).

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and the 'seeing'. There is much activity around underlabouring, sweeping away, and using CR tool kits to scaffold the reader's understanding of the philosophical and methodological paradigms employed here. In this respect, the critical realist assumptions are uncovered to make concrete the connection between the philosophical underpinnings driving the social realist methodological choices in this research.

1.3   Researching and theorising a Complex Problem

Bringing a critical realist perspective to an analysis of the effects contemporary data uses are having in education refocuses the attention on what can be known from data (thinking epistemologically) and what data really are (thinking ontologically) (Williamson, 2018). In this research, CR supports an epistemological examination of the ways data are framed, how people make sense of data, and how different lenses might support different interpretations of data. Ontologically, a CR approach exposes and questions the consequences of data shaping agential action, experiences, decisions and choices across educational strata (Williamson, 2018). Here the rise of data use is reconceptualised as both a societal and educational phenomenon. In this respect, CR supports research that is likely to uncover generative mechanisms and emergent social relations (Gable, 2011). Accordingly, a CR underlabouring process was employed to problematise and propose an alternative approach to investigating the contradictory tensions in school improvement and accountability policies in schools.

Here, the research focuses on the impact that data-based interactions and governance are having on schools, yet it begins with a wider analysis of the conditions that have wrought these changes. This theoretical stance argues that broader understanding lies in considering the context in which these interactions take place (Case, 2013). In this respect, the research is located across several contextual strata, where the research moves from infrastructural and institutional levels to relational and individual levels in the search for generative mechanisms and significant social relations. Here Archer's (1995) social realist theories of structure, culture and agency support the analytic distinctiveness of these domains and consequently provide practical methodological support to the CR underlabouring.

In recognition of the hybrid methodological choices made here, the research sought answers to two categories of questions. The first focused on the affordances of a CR stance aligned with the morphogenetic approach in educational research. The second accounted for domain-focused questions.

Methodological questions

- What are the advantages of a critical realist toolkit when researching data use in Queensland primary schools?
- How does the morphogenetic approach support research into agential transformation in education?

Domain-focused questions

- What pre-existing structural and cultural conditions influence the way data are used in Queensland primary schools?
- What are the key dimensions of data use in Queensland primary schools?
- How does engagement with data inform professional practice and teacher learning in primary school contexts?
- How might data use constrain or enable principal-teacher agency within the Queensland state primary school environment?

A fundamental premise of critical realism is that it can reveal the workings of social structures, and therefore expose the problems associated with the underlying structures and mechanisms present in education systems (Shipway, 2011). This stratified approach affords a 'healthy scepticism' regarding the structures and cultures in education that may be entrenched and therefore taken for granted (Corson, 1998). In this sense "CR is a process of discovery", the sense-making referred to earlier, where educational structures and cultures likely to restrict human action are uncovered (Corson, 1998, p. 4). Therefore, a major role for the CR researcher is to "untangle the intricacies of how wider social structures and mechanism 'filter' into educational organisations" (Shipway, 2011, p. 175). In this instance, this research project sought to examine the complex sociocultural interactions that characterise the uneven relationships (supervisory rather than relational) emerging from new forms of data use in schools (Corson, 1998, p. 208).

Accordingly, this research context considers the tension that emerges when schools are subject to dual sets of requirements (structures) placed upon them by inconsistent modes of school improvement and accountability policies and strategies. School staff might be pulled one way by the power relations associated with one government organisation/body and at the same time, a culture of accountability might push them in another direction (Shipway, 2011). Within an expanding domain of data accountabilities, schools are subject to contest between horizontal (democratic accountabilities towards community) and vertical forms (attenuated accountabilities—beyond the local, national, and regional—that operate in the global (Vidovich, 2009). These pushes and pulls of accountability structures make it difficult for staff to see past the pressures and find

ways of working that address these multiple sets of dependencies and responsibilities (Shipway, 2011).

This research is supported by "a stratified CR conception of power with a multilevel view of causality" (Shipway, 2011). In this respect, all government and educational bodies, individual schools, their respective staff communities and unions can be seen as "real, structured and enduring entities, with real powers and tendencies" (Shipway, 2011, p. 194). Conceiving these powers (and how they interact) as real, directs attention to the structural and cultural conditions that might enable and constrain agent action and agency concerning data use at a school level (Archer, 1995). It also considers the contested nature of research into data in education and the characteristic acceptance (without examination) of the development of new ways of knowing afforded by data (Bowker, Baker, Millerand, & Ribes, 2010). Here, this research advocates a multi-modal and integrative approach that moves freely between the social, organisational and cognitive dimensional layers to uncover emergent phenomena (Bowker et al., 2010; Selwyn, 2015).

1.4 **Methodology**

This research project argues that critical realism supports several methods, including case study research. However, in the face of relatively new and somewhat fragmented knowledge bases surrounding data use in education, an iterative approach was adopted. In this respect, no single complete theory was expected to guide data collection and analysis; instead, "the identification of 'best-fit' theories" was relied on as more data were accumulated (O'Mahoney & Vincent, 2014, p. 15). This approach aligns with Cruickshank's (2003) conception of 'domain-specific' theory where a general realist understanding is drawn on to scaffold the study of a specific empirical domain (O'Mahoney & Vincent, 2014). Here the objective of critical realist underlabouring is to improve one's capacity to be reflexive (Bhaskar, Danermark, & Price, 2017); yet, methodologically this does not necessarily supply a workable research process.

In the face of no distinct research direction, and following Gable (2011), Dobson, Jackson, and Gengatharen (2013) and Raduescu and Vessey (2008), this study implemented a six-stage explanatory model of critical realism which guided this research between the concrete and abstract (Danermark et al., 2002). Here the process of abstraction combined with a retroductive methodology strengthened research claims about the phenomenon. Stages 1-3 of the model were used in Chapter 3 to conceptualise the research and consider questions and concerns, and Stages 4-6 were interwoven in the data analysis presented in Chapters 5-7. From this strategic movement between abstraction and theorisation emerged a tentative reflexive understanding of the

phenomenon and directional guidance as to which approach might be appropriate in the circumstances.

Subsequently, the intensive qualitative case study approach adopted here focused on providing a causal explanation of certain objects and events across settings (Sayer, 1992). This intensive case design incorporated a retroductive mode of thinking that asked: what must the world be like for data to have effects in schools? In this respect, it looked for explanatory power in the way that structural and cultural properties interact with agents across a stratified context and different timepoints. These emergent relations and the interpretation of these relations by relevant social actors became the focal point of this research, alongside the search for causal mechanisms.

Archer's (1995) morphogenetic approach framed the theoretical rationale for the choice of research and data analysis methods. The morphogenesis approach established the forms of structural, cultural and agential relations and the nature of socio-cultural interaction between those relations encountered within each school site (Lipscomb, 2014). In each instance, a sense-making exercise was concerned with 'how people generate what they interpret in terms of (1) the nature of how and why aspects are singled out from the stream of experience; and (2) how interpretations are made explicit through concrete activity" (Lycett, 2013, p. 383). This established the basis for the comparison of possible causal mechanisms across school sites.

1.5   Outline of thesis structure

This section provides a brief overview of each chapter, outlining the structure of the thesis as it moves through the research process.

Chapter 2 presents a problematisation of the research space. It focuses on some of the contemporary challenges facing teachers in this century. The nature and role of data in schools are positioned as contentious where the question might be; is the data being used for school improvement or accountability purposes or an accumulation of both policy drivers? Consequently, the chapter is a synthesis of educational literature presented against a framework of associated tensions and problems. The objective of the review of the research base was to find an entry point into the research space; what emerges is a contentious knowledge base. This foreshadows further conceptual, methodological ground-clearing work in the subsequent chapter whereby a rationale is developed for the practical, philosophical and sociological approach adopted to position the research project.

Chapter 3 describes the evolving critical realist philosophical toolkit and the social realist methodological framework adopted in this study. It argues that associated tensions and conflict in

the knowledge bases have real effects in the social world. Accordingly, the utility of critical realism as a philosophical underlabourer (Bhaskar, 1989b) is proposed. The fundamental nature of the structure, culture, and agency debate is exposed, and Archer's high-level methodological approach is recommended as a possible methodological solution. The chapter is structured through the initial stages of a six-stage explanatory model. While the critical and social realist underpinnings of the research are examined here in detail, non-CR readers might prefer to read the chapter with the accompanying glossary.

Chapter 4 sets out the research design and the subsequent approach to data collection and analysis. It presents an understanding of the methodological consequences of choosing Margaret Archer's (1995) morphogenetic approach for this thesis. Critical realism as a philosophy for social science does not recommend particular research methodologies to the researcher. It offers broad methodological strategies (such as retroduction, retrodiction) that connect theory with research in a semi-structured way. The resultant comparative case study provided causal explanations of events in terms of both the actors' interpretations and the structures and mechanisms that interacted to produce the outcomes that eventuated (Edwards, O'Mahoney, & Vincent, 2014; Sayer, 1992). The case study sites were four state primary schools located in South-East Queensland.

Chapters 5, 6 and 7 present data analysis over multiple layers of context. Chapter 5 traces emergence across infrastructural and institutional contextual strata. Chapter 6 operates as a methodological bridge between Chapters 5 and 7 making apparent the underlabouring process. Chapter 7 shifts the analysis to the individual agential level. Here, particular configurations of factors or situational logics are considered likely to have generated identifiable outcomes.

Chapter 5 is presented as an analytic history of emergence—a morphogenetic account of the infrastructural and institutional layers of an educational system. Against a backdrop of global educational policyscapes, this chapter explores the recent origins of data use in an Australian education context in preparation for further analysis in Chapters 6 and 7. In this respect, it establishes a historical context which serves to frame the rest of the analysis.

Chapter 6 is a general structural and cultural analysis of how the case schools at a *relational* level respond to new school improvement and accountability policies concerning data use. It establishes four critical contexts that agents are required to negotiate: an explicit school improvement agenda, datafication, effective leadership and increased accountability (individual teacher focus). This initial identification of the structural and cultural arrangements of each school re-cases the study and reduces the focus to agents' relationships with data at an *individual* level in Chapter 7.

Chapter 7 reduces the focus of the case study to propose explanations of outcomes at an individual level. This comparative understanding recognises the different socio-economic backgrounds, histories, challenges and issues of each case site as it theorises the extent that contextual factors and emergent causal mechanisms enable or constrain each schools' potential to support, subvert or ignore the structural conditioning cycle of new data approaches embedded in the emergent and sometimes paradoxical school improvement and accountability meta-structures.

As the final chapter of the thesis, **Chapter 8** concludes with an understanding of the possibilities and problems associated with how and why each school, and the teachers as agents within, negotiated these new data regimes and relations. It revisits the advantages and challenges of adopting a retroductive methodology and realist social theory in the form of Archer's morphogenetic approach for explanatory purposes. In this light, Chapter 8 moves the discussion beyond the empirical outcomes and considers the implications of the rise of data use in schools through a realist social understanding and what it might mean for the potential to make progressive changes in the education system.

1.6   Research Implications and Limitations

The background and rationale for this thesis research have been presented and aligned with the ontological, epistemological and methodological preferences. Why then critical realism? On the face of it, CR offers a framework that binds the researcher to a series of ontological commitments— "what we believe exists, affects our epistemological concerns" which relate to what we believe can be studied and known about the world (O'Mahoney & Vincent, 2014, p.1). This, in turn, is reflected in our methodological choices. These choices promised a research process that was both rewarding and challenging in the same instance. This investigation into the complex interactions that took place in schools concerning data use employed a conceptual framing that reached beyond a positivist view or social constructionist understanding to consider the social relations emergent from these new interactions. This broader view ensured a search for causal mechanisms likely to be interacting to produce the outcomes observed, essentially new ways of knowing. However, these emergent properties and mechanisms were not directly observed, meaning that they had to be "painstakingly reconstructed by iterative empirical research guided by theory" (Ackroyd, 2004, p. 155). This piecing together of empirical evidence was a slower process, albeit rewarding in the end.

In addition, to establish mechanisms and causality, this research also drew on realist inquiry to further expand on and inform the morphogenetic approach. In this respect, the methodology/ies that ensued were to some extent, hybrid in approach. However, critical realist underlabouring

supported this iterative building of methodology along the way. Further explanations are included as conceptual and methodological scaffolds in the development of this thesis.

1.7 **Summary**

This chapter has introduced the research and provided the beginnings of a rationale for theoretical and methodological choices for this project. Keeping in mind the benefits of a good narrative and not giving away too much of the story, consider the reading of this thesis as a journey that you have become part of. Following a slightly less worn path, a description of the research process, methodologies, data analysis and outcomes follow.

2. Problematisation of Research Space

2.1 Introduction

This chapter focuses on some of the contemporary challenges facing teachers in this century. It highlights the contradictory tensions emergent from the nature and role of data in schools. The examination reveals several extensive (rapidly evolving, yet fragmented) knowledge bases concerning educational accountability, school improvement, as well as debates about the role of data in contemporary educational governing practices (Williamson, 2016). In view of this, Chapter 2 is a synthesis of educational literature drawn largely from the United Kingdom, the United States and Australian contexts. It is presented against a framework of associated pressures and problems pertaining to the rise of neoliberal policies from the 1990s in order to find an entry point into the research space. This foreshadows Chapter 3, which develops a rationale for the practical philosophical and sociological approach adopted to better position the research project.

Schools are complex places. Not only do they exist in time and place in their own community, they are also located in a wider context of organisations and systems, each in turn, providing further layers of conditioning. Proposing an alternative way of examining how schools are responding to new data initiatives recognises this complexity and signals a commitment to untangling this research problem. An initial assessment of the knowledge bases indicated disparate understanding of the data in the education phenomenon. It revealed a contested research space where key actors and agents have their own indicators and purposes, and where education research communities work in parallel with policy and government agencies, sometimes interacting to define new educational imaginaries (Lawn, 2013a). Finding a methodological entry into this "new cognitive space in education" (Lawn, 2013a, p. 10) presents a serious challenge. Accordingly, adopting the meta-theoretical framework of CR supported a reconceptualisation of the research phenomenon and a way forward.

2.2 Researching and Theorising a Complex Problem

The rise of data to describe, represent, rationalise or explain education systems emerged in the middle of the nineteenth century as a means to record education systems and their inner workings (Lawn, 2013). Generally, data pertaining to school administration, budgets and attendance were recorded annually, alongside some visual images to emphasise on particular aspects of an educational system (Lawn, 2013). It was increased amounts of data collection, the move to find patterns and the growth in the science of statistics that formed the basis of the "virtual world of data" that people inhabit today (Lawn, 2013, p.8).

Accordingly, the use of data in education is not new. However, the evolution of more focussed data use in education has been marked in recent years and while the research base has attempted to keep pace, it can appear somewhat disorderly depending on the focus of the researcher's interests. Different research traditions emphasise alternative methodologies and may use different language to conceptualise similar phenomena (Coburn & Turner, 2011a; Perkins & Engelhard, 2011). There is limited consensus within the research space given that research programs sometimes ignore or seek to refute other research outcomes. For example, mathematical modelling, as an influential research strategy in educational research, attracts equal parts criticism and favour (Scott, 2000) dependent on context and purpose. This quantitative-qualitative divide has occupied researchers attempting to resolve the associated (and perceived) epistemological and ontological differences for a number of years (Scott, 2013). These research base differences are further exacerbated by the appropriation of research findings by organisations to promote policy and strategies across educational levels.

Efforts to build a more comprehensive and balanced research base have been hampered by the perceived power of metrics, where numbers and the framing of data alters the way people see the world and even how they conceive of knowledge in the world (Milan & Van der Velden, 2016). An exception is the work in policy sociology which has criticised the transformation of educational governance across a number of systems, particularly the rise of the role of data in performativity in education (Anagnostopoulos, Rutledge, & Jacobsen, 2013; Grek, 2009; Sellar, 2014). Selwyn (2015) argues these studies account for "the ways in which data production, data management and the associated state of 'constant comparison' now underpin how education systems are now governed and controlled" (p. 67). Noticeably, however a single perspective has yet to emerge; one that encompasses the range of relations and connections and one that entails an "active engagement with the practices of others in this environment" (Sellar, 2015, p. 775).

Accordingly, while there has been some emphasis on aspects that might influence data use in education, there is less focus on how these relations might interact with each other and what the consequences of this interaction might be for schools and teachers (Coburn & Turner, 2011b). One of the key issues is that data is both problematic for schools and is seen as essential for school improvement (O'Day, 2002). Consequently, the nature and role of data in schools is positioned as contentious where teachers are expected to negotiate contemporary accountability policies and practices that emphasise the quality assurance dimension of data use at the expense of the improvement or enhancement data use dimension (Vidovich, 2009).

This dualism exists as a source of internal and external tension and conflict for schools not easily resolved. The processes of quality assurance and enhancement, intertwined as they are, make it methodologically difficult to separate into a coherent understanding of the research problem. Focussing on either perspective fails to recognise the complex interactions that take place to negotiate this contradictory space. Alternatively, the elision of accountability policies and school improvement processes reduces the opportunity to focus on the role of data and interaction in systemic change and school improvement.

With these complexities in mind, the research task of presenting an explanation of school responses to new uses of data across contemporary education systems requires some consideration. The following high-level scan of literature revealed broad understandings of the shifts in this field and their joint positions as part of larger social structures. However, this very breadth made it conceptually difficult to sift through the layers to uncover or abstract the mechanisms (the links and connections) that might be influential on the ground. What conceptual tools might better reveal circumstances in schools that shape or are shaped by teachers' responses to new data initiatives? The methodological challenge is to reduce this complex landscape to single out conceptual understandings that makes sense of the data use and the emerging social relations in the context of each school case. Anticipating a critical realist focus, this next section examines data use within a stratified survey of current trends and typologies in school accountability. This synthesis of educational literature, which might contribute to knowledge of the research problem, is presented against a framework of tensions and problems and includes accountability relationships, data processes and datafication, school transformation and data routines/sensemaking.

2.3   **Performative and Professional Accountability Relationships**

The idea of accountability and the way in which society understands and defines accountability has transformed significantly in the last decades (Biesta, 2004). Examining different questions of "accountable to or accountable for what" and "to whom is one accountable to" and "who has the power to call for an account" makes more transparent the notion of power relations that are implicit in the ideas of accountability (Epstein, 1993, p. 248). It also calls attention to how the current understanding of accountability has affected relationships; and the types of relationships that are made possible, and impossible, by these new accountability structures (Biesta, 2004). The consequences of this contested space and the implications for teachers is central to this research.

The growth of accountability and auditing as a practice accelerated in the 1990s and "the audit society" (Power, 1997) resonated with a public becoming familiar with target-setting and surveillance. Positioning the rise of measurement in education alongside this wider social

transformation recognises the ascendancy of data for the governing of education (Earl and Katz, 2006). The emergence of the culture of accountability in education (Biesta, 2004) is underscored by the growth in numerical data available as a result of testing, comparisons, productivity audits and the rise of powerful digital technologies (Lawn, 2013b). Large-scale policy actor appropriation of data has led to new social imaginaries[3]—education spaces that are bound by increasing focused interventions and governance controls (Coburn & Turner, 2011a; Lawn, 2013a; Lingard, Rezai-Rashti, Martino, & Sellar, 2015). These imaginaries, in part invoked by the alignment of increased use of data with improved productivity in the economy, are tied to the notion of educational crises and failure to compete on an international scale. Global ideologies are constantly seeking influence over the "social imaginaries of policy actors everywhere, but in ways that are mediated by national traditions, local politics" and individual agents (Rizvi and Lingard, 2010, p.1). Accordingly, considering how competing imaginaries shape thinking about how things are draws attention to how data use linked to performance raises the accountability stakes for schools, and where sanctions and rewards are applied ensure data are used to improve student outcomes and increase educational impact in schools.

These shifts in accountability are framed against the rise of neo-liberal and new public management forms of accountability in the global community over time. The move from "professional and democratic notions of accountability to the current hegemony of the technical-managerial approach" (Biesta, 2004, p. 236) is inherent in the transition of society itself from political relationships to economic relationships where government demands accountability in exchange for the provision of financial resources. Ranson (2003) comments: "To be accountable, conventionally, is to be *'held to account'*, defining a relationship of formal control between parties, one of whom is mandatorily held to account to the other for the exercise of roles and stewardship of public resources" (p. 460). These contrasting conceptualisations position accountability as a contested space, one which continues to change as new interpretations emerge.

The rise of new forms of accountability and governance (Ranson, 2008) is evident across education sectors. The increase in assessments, evaluations, inspections and reporting demands that Lingard and Sellar (2013) describe as the 'intensification' of audit and technical-managerial accountability processes are designed to motivate individual and systemic change. This is a shift

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[3] Here the idea of social imaginaries follows Rizvi's (2010) understanding of a framework of descriptive and prescriptive conceptions of how things work in a context (here education) and how practice emerges and is organised around often complex sets of norms that build meaning around these practices. In this respect, social imaginaries are not always fully articulated or indeed their effects understood or interrogated by the people whose ways of thinking are informed by these ideas (Rizvi, 2010).

away from former understandings of accountability as a system of mutual responsibility rather than a system of governance (Biesta, 2004; Charlton, 2002). Within this earlier discourse, teachers were accountable, as part of their professional standing, to themselves, to their peers, their students and parents and to the community, and not in response to an external demand (Poulson, 1996). Fundamental to this is a general understanding that asking schools to be accountable to students, parents and the community would support the democratisation of education and promote more meaningful modes of accountability practices (Epstein, 1993). The transformation in education from models of democratic and professional accountability to versions of accountability consistent with the age of neo-liberalism governance has produced a complex raft of new modes of 'accountabilities'.

These models are predicated in the understanding that accountability is a social practice designed to produce certain outcomes and made possible by sets of relationships and evaluative processes (Ranson, 2003). However, the role that the interaction of data and accountability play in the construction and continuation of social relationships and roles in institutions, and what contributions it makes to the construction of social and educational norms is a site of contest (Poulson, 1996). How accountability policy implementation reshapes the power relations between teachers, principals, schools, the state and communities (Coburn & Turner, 2011b) and for what purpose, is subject to much scrutiny. The literature asks how might "the discourse of accountability relate to how power is exercised within the domain of accountability and to what end?" and what is the nature and status of objects of knowledge created in relation to accountability? (Poulson, 1996, p. 583). Where can the rise of data production and access for educational accountability be situated in this debate?

Policy actors and researchers who seek to answer these questions are divided: those who challenge the hegemony of data and the technical-managerial accountability that it supports (Gable & Lingard, 2015; Hardy, 2015b; Lawn, 2013a; Lingard, 2011; Ozga, 2009; Sellar, 2015), and those who appropriate the discourse of data as a tool for school improvement and accountability (Campling, 2012; Productivity Commission, 2017; SIU, 2016; Turner & Coburn, 2012). Consequently, the debate is driven by conflict at both an epistemological and ontological level about the nature and role of increased data use in the education space.

In turn, there is a trickle-through effect which sees data use shaping educational practices as a contested space played out across various locations. Diverse sites including leadership (Bloxham, 2013; Datnow, Greene, & Gannon-Slater, 2017; Gurr, 2007; Møller, 2009), legislation and policy (Apple, 2004; Ball, 2008; Caldwell, 2007; Darling-Hammond & Rothman, 2011), professional

development, professionalism (Biesta, 2015), collaboration and norms of interaction (Coburn & Turner, 2011b; Earl, 2008; Timperley, 2008) and initial teacher education (Mandinach & Gummer, 2016) indicate the extent that data use as a power relation is a significant driver or generative mechanism[4] for accountability and educational change. In view of the scope of the literature, an exhaustive examination of the impact and effect of the data use in schools promises to be complex. How schools negotiate the validity of policy and practice in this shifting space is challenging. While there is recognition that appropriate data use promises better outcomes for students, it is the contested space within which this is enacted that imbues the internal and external social relations with tension and unease.

This next section examines the technical affordances, impact of new data systems and the contested knowledge bases rapidly emerging from data use in education and considers how these might be used to frame a conceptual understanding of the changing social interactions in schools.

2.4   New Understandings of Data Use in Education

Frameworks that consider the processes of data use in education emphasise the fundamental role of interpretation. As Coburn and Turner argue, "Data does not speak for itself" (2011b, p. 177). In one sense, data use is understood from a theoretical perspective of interaction and sensemaking, as agents must actively engage with data, make meaning from data, and then construct implications for action from data. This theory of data interaction and interpretation offers a relatively straightforward approach to unravelling the complex interplay of data use, teachers and school contexts. The reality is far more problematic as evidence in the form of data is rarely simple and can be "interpreted in many different ways and is as likely to be contested as the theories on which it is based" (Earl & Timperley, 2008, p. 7). Data use is a complex and nuanced enterprise (Earl & Timperley, 2008; Farrell & Marsh, 2016) which takes place within school systems which in turn are nested in larger systems and environments (O'Day, 2002). Thinking about data use across a number of levels signifies that conceptualisations of the relationship between ontology (What data are?) and epistemology (What can be known from data?) are likely to be central to an understanding of the social world of data in education (Scott, 2013). It is therefore argued that meta-theoretical tools that respect a stratified understanding of the social world are likely to extend knowledge of how data use is shaping school contexts.

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[4] See Glossary for a definition of generative mechanism.

The lens of datafication, as a way of understanding the complexities of data use is utilised across a number of sectors including education (Hardy, 2015b; Hardy & Lewis, 2016; Sellar, 2014). The 'newness' of the concept belies its roots in a historical understanding of the rise of data use (Lawn, 2013b) where, for example, the early uses of data in education as means of comparison of effectiveness of performance rates (Lawn, 2013b) have transformed into the comprehensive comparative analysis of performance in large-scale assessments that drive global educational policy today (Williamson, 2016).

Datafication refers to "ways of seeing, understanding and engaging with the world through digital data" (Williamson, 2018, p. 1). Within this perspective, data makes things visible, whether individuals or groups notice or not (Coburn & Turner, 2011b), knowable and explainable, and this can lead to action (or inaction) or intervention (Williamson, 2018). Datafication also acknowledges the increasing reliance of education systems on data and data infrastructures and the possibilities of data being something that adds value in an educational space (Lycett, 2013). Williamson (2018) contends that datafication can be defined in multiple ways and I would argue on multiple levels as data use plays out across different contexts. Conceptually then, datafication is seen as a sense-making process which articulates how agents notice or choose what they pay attention to and how they respond via concrete activity. This implies a data agency and the possibility of critical engagement, where agents are able to create "alternative epistemologies of what data means and represents" (Milan & Van der Velden, 2016, p. 68). Fundamental to this is comprehending the nature of data and its construction, interpretation and enactment in the social world.

2.5   What Can Be Known from Data?

Accordingly, considering data use from an epistemological viewpoint uncovers the mediated knowledge that exists within what can be known from data. From one perspective, datafication supports belief that findings from data sets are objective representations of, and can provide knowledge of complex phenomena (Williamson, 2018). Kitchin (2014) suggests it is "a powerful and attractive set of ideas at work in the empiricist epistemology that runs counter to the deductive approach that is hegemonic within modern science" (p.4). These ideas argue that through *value free* data analytics, data speaks for itself, is "absent of human bias or framing, and that any patterns and relationships within (big) data are inherently meaningful", reliable and truthful (Kitchin, 2014, p.132). This absenting of human influence goes beyond contextual and domain theorising and suggests that this kind of data is potentially interpreted by anyone who can decode a data representation or visualisation (Kitchin, 2014). Consequently, data tend to be accepted as represented and considered inherently meaningful with little or no examination by agents.

Milan and Van der Velden (2016) argue "these new epistemic cultures shape the way we relate to knowledge and its validation, how we understand and filter the world around us as well as our experiences"(p. 63). Accordingly, these new ways of knowing warrant a form of 'data activism', one that might challenge the acceptance of normative "politics of knowledge" and mediate between the growing "algorithmic culture" and communities in general (Milan & Van der Velden, 2016, p. 64). This perspective argues for a form of agent empowerment—one that recognises that a critical engagement with data supports ways of knowing the social world that might expose some of these underlying assumptions that lead to inequitable social relations in educational settings. Consequently, this research into the effects of rising data use in education considers how these uneven relations might be studied. Part of the explanation lies in understanding how individuals and groups interact with data and the possible outcomes of these sensemaking actions. In this respect the next section considers data and data narratives in educational spaces.

2.6   **Unpacking the Black Box**

Ideas situated in the world of data analytics argue that with enough data, the numbers and metrics are able to speak for themselves. For those who support these empiricist epistemologies, the challenge lies in how to deliver value alongside this data and how to make sense of this data. It is in this space that a model derived from business (Normann & Mintzberg, 2001) provides what Lycett (2013) terms a logic of value creation. Dematerialisation, liquification and density, are concepts drawn together in an explanatory framework making transparent what can be *done* to data to extract value *from* data (Lycett, 2013 italics added). Rearticulated to relate to education, dematerialisation[5] is the separation of data from its original informational aspect and its use in a particular context. Liquification is data made fluid allowing it to be moved around and within an infrastructure (Anagnostopoulos et al., 2013), "unbundled and rebundled" in preparation for new ways of making sense (Lycett, 2013, p. 382). Finally, Lycett argues that density is "the best (re) combination of (data) resources, mobilised for a particular context, at a given time and place—it becomes the outcome of the value creation process" (p. 382).

The concepts of dematerialisation, liquification and density are manifested in the treatment of standardised achievement tests which drive performance within education accountability systems both nationally (NAPLAN in Australia) and internationally [Programme for International Student Assessment (PISA)]. These processes of commensuration, defined here as the "transformation of

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[5] Dematerialisation implies the materiality of data, whereby data can be instilled with more than its face value, where data are part of an assemblage and where the possibilities and constraints of data can be reconfigured and emerge as something different (Fenwick, Edwards, & Sawchuk, 2011)

different qualities into a common metric" (Espeland & Stevens, 1998, p. 314), render some things visible and others hidden. Commensuration as a process of abstraction is not value free, choices have been made as to what data to collect, how it is processed, repackaged and disseminated, who gets to see what and in what form. These decisions are all questions of power (Anagnostopoulos et al., 2013).

Returning to the research space, data sense-making therefore holds a challenge for what schools can and cannot know about student learning and school outcomes. While data is a visibility-making technique (Landahl & Lundahl, 2013), there are also tensions and associated challenges with the act of seeing (Lawn, 2013b). In accounting for the effect of data, Williamson (2016) argues:

> …the technical aspects of public policy instruments (the software, its code, algorithms and database architectures) and their social aspects (the organizations and actors producing them, their representations about education, their values and the discursive regimes framing them) combine to 'organize social relations between administrative and administered subjects'.

> (Carvalho, 2014a, p. 59) pp. 125-126)

Framing this quandary and drawing attention to the imperfect power relations surfaced here, Lycett (2013) argues that three challenges to sensemaking require research attention; conceptualisation and codification, algorithmic treatment and the re-representation of the world (through visualisation). Each of these data interventions warrants interrogation as they represent a wider methodological shift in governance in education systems (Williamson, 2016).

A digital sociological approach to data presupposes a critical eye on the understanding that data are broadly neutral, objective and therefore unchallengeable in nature (Selwyn, 2015). How data are arrived at, conceived and coded is the work of instruments that are:

> The bearers of values and interpretations of the social world that are materialised and operationalised by particular concrete techniques and tools, and as a result have the capacity to partly structure policies, determine how actors behave and privilege how certain representations of problems are to be addressed.

> (Williamson, 2016, p. 125)

This materialist approach to data recognises some dilemmas of data and the pre-existing frames of reference that inform them. These formulations are fixed in time implying that any knowledge of

the world drawn from these frames of reference becomes decontextualised and static, post collection, where in fact the world is continually emergent (Lycett, 2013). Although real-time responsive data (i.e., attendance and exclusions) are becoming more prevalent, much digital data collected as part of formal governance structures continue to rely on annual achievement testing.

Drawing on standardised tests (National Assessment Programme – Literacy and Numeracy (NAPLAN) as an example, data is collected from schools in May, removed, quantified and synthesised from sets of data points. It then must be recontextualised and disseminated back to schools in August as multiple data sets that purport to measure teachers' performance through the achievements of students within their class. The pervasive understanding that, by providing standardised metrics, these abstractions can tell the story of a classroom is regularly questioned (Howell, 2012; Lingard, Creagh and Vass, 2012; Thompson & Cook, 2012). What is missing is the critical knowledge of how these frames of references are arrived at and the conceptualisations and codification that have shaped and reconstituted the data (Lycett, 2013; Sellar, 2014).

A second challenge to sensemaking is the largely invisible algorithmic treatment of data and who (or what) chooses what tests and algorithms are used to quantify teacher quality and student learning (Anagnostopoulos et al., 2013). Lycett (2013) argues that attention should be given to the algorithms that clean, and find patterns and relationships in data for two reasons. Firstly, these systems tend to be closed in nature and this is consequential because the classifications built into these systems not only "extract and derive meaning from the world…they are increasingly starting to shape it" (Lycett, 2013, p. 383). Following this is how this 'shaping power' is derived, what classification systems are linked, what ideologies and interests are invested in them (Anagnostopoulos et al., 2013) and what are the consequences of collaborating and conflicting algorithms operating in the same information infrastructure. This abstraction of education through digital technology requires further examination of the classification systems, both those informed by policy and as well technological infrastructures, to understand the power disparities and the resulting new forms of governance in school systems (Anagnostopoulos et al., 2013; Thompson, 2016).

A third challenge to data sensemaking is how data represent the world and how data are re-presented to the world (Lycett, 2013). As the technological affordances of data have grown, so too has the sophistication of the visualisation processes that accompany the dissemination of data (Lawn, 2013b). Real-time, dynamic and aesthetically pleasing sites have been developed that allow the user to interact, via search engines and filters, to seek certain data or patterns in the data. These visual renditions of data suggest two positions that bear examination. Visualisation processes are

part of an assemblage; they are instruments that, like algorithms, are bearers of values and interpretations of the educational world (Williamson, 2016). Consequently, they are designed with an outcome in mind; as concrete tools, data sheets and dashboards, they have the capacity to structure opinion and shape policy across macro-, meso- and micro-educational strata. Williamson (2016) describes them as "the hybrid product of political aspirations to manage and orchestrate the flow of school data with the capacity of software to provide an apparently neutral, non-political interface" (p. 131).

An Australian example is MySchool, the government website which reports on NAPLAN results each year. The site uses a variety of criteria to evaluate schools against each other, (each school is compared to sixty 'like schools'), and as Thompson and Cook comment, "the principal justification for its introduction is to constitute a mechanism that measures, and therefore produces, 'good teaching'" (2012, p. 130). MySchool makes schools "see-able" to the community and consequently adds a further layer of accountability and governance (Lewis & Hardy, 2017).

A parallel understanding of data re-representation is the consideration of how agents and actors consume data, and how they actively navigate and interpret data held within these new data structures. New actors are emerging in this space, those who are invested with a "certain form of data power" (Williamson, 2018, p. 2). These experts appear across multiple domains from those actors who can work with complex data systems through to teachers who are "good with data". In each case, these experts are tasked with the role of analysing complex data sets, visualising and then re-representing and re-presenting them in a way that will ensure the audience notice and act upon the data (Coburn & Turner, 2011b). At a school level, this can be a site of contestation as data collected from standardised testing are open to interpretation and suggests that meaning might be constructed (Anagnostopoulos et al., 2013).

Within this understanding of informatic power (Anagnostopoulos et al., 2013) these data analysts and experts use 'visualised facts' to knowingly or unknowingly shape responses to data. This begins to "acknowledge the unequal agency that individuals and social groups can hold when engaging with digital data"; here the lines are drawn between those who 'can do' data and those who are on the receiving end of data (Selwyn, 2015, p.71). This stark contrast is echoed in the notion of a hierarchy of data classes where the power differentials are drawn across lines of technical and statistical expertise (Manovich, 2011; Selwyn, 2015). Here, a better understanding of how data and data systems are engaged with and experienced by different actors in education systems is advocated.

Data expertise is not necessarily a prerequisite for teachers and despite more focus on capacity building in this space (Mandinach & Gummer, 2016), recent research indicates that teachers and administration staff tend to focus on data that supports their own beliefs and experience while ignoring data that contradicts their tacit understanding (Coburn & Turner, 2011b). Teacher knowledge and motivation are also complicit in how teachers make sense of data (Earl & Katz, 2006). Furthermore, interacting with data and data sensemaking is not carried out in isolation; schools are social spaces and as a consequence the social interaction and social relations informed by data use are also important. So too is the challenge of converting data into useable knowledge that teachers are able to draw upon in addition to their own understanding (Hubbard, Datnow, & Pruyn, 2014). This professional learning approach relies heavily on the data skills, knowledge and motivation of leadership teams (Earl & Katz, 2006); however, there are some indications that the level of expertise required is not always present (Earl & Timperley, 2008). Accordingly, improved 'data literacy' of both teachers and leadership teams remains crucial for successful data impact in schools.

2.7   **Transforming Schools – Educational Reform and School Improvement**

As the technological affordances of data have multiplied, there has been a parallel challenge from government agencies for educators to use data to drive educational reform. The stress on data use to improve student outcomes has escalated in the UK, US, Canada, Australia and other countries. This is in part due to the rise of the neoliberal educational imaginary which locates education in a competitive space through the efficiencies of global testing such as the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS). The commitment to data use across all sectors and the indisputable neoliberalist connection between data, the economy and productivity are articulated in a recent Productivity Commission report:

> Effective use of data is increasingly integral to the efficient functioning of the economy. Improved availability of reliable data, combined with the tools to use it, is creating new economic opportunities. Increasing availability of data can facilitate development of new products and services, enhance consumer and business outcomes, better inform decision making and policy development, and facilitate greater efficiency and innovation in the economy.
>
> (Productivity Commission, 2017, p. v)

This neoliberal focus has attracted much critique from educators and researchers located in various parts of the world (Anagnostopoulos et al., 2013; Ball, 2008; Lawn, 2013a; Lingard & Sellar, 2013; Ozga, 2009; Sellar, 2015). Nevertheless, there remains fundamental confidence in many quarters that data-driven decision making will result in real educational reform. Consequently, schools are asked to reposition themselves as data-responsive entities—organisations that learn and are capable of real change at a fundamental level.

How schools are supposed to change is determined by the lens adopted by government or educational agencies who formulate policy. Although this focus is increasingly influenced by policy actors in the form of edu-businesses, independent think tanks and research organisations (Hogan, 2016; Hogan, Sellar, & Lingard, 2015), their origins lie in two research traditions. School Effectiveness (SE) and School Improvement (SI) research in the UK, School Effectiveness Research (SER) in the US and Educational Effectiveness Research (EER) in Europe have developed in order to validate the belief that schools make a difference and to investigate the conditions and strategies that promote school improvement (Harris & Bennett, 2004). However, over time, these two research traditions diverged. School improvement researchers and evaluators became more intensely focused on change processes and implementation issues and frequently applied qualitative research methods and case studies, while school effectiveness used predominantly quantitative methods (Scheerens, 2016).

The association of school effectiveness and improvement research bases with new data-enabled accountability practices results in a complicated landscape (Reynolds et al. 2007) where the purpose and audience of each research base and what or whose requirements are being met have been questioned (Biesta, 2010). Superficially, the aim of the research, to describe and understand what projects, interventions, and innovations help schools become more effective learning environments for all students (Hopkins & Reynolds, 2001; Hopkins, Stringfield, Harris, Stoll, & Mackay, 2014) appears relatively unproblematic. In the UK, where influential instances of both can be found, school effectiveness research focuses on: quality and equity in schooling; determining why some schools were better at promoting positive outcomes for students; how and if school performance is consistent over time and the characteristics that make for better education outcomes for students (Stoll & Sammons, 2007). Concurrently, the expansion of the school improvement discipline involved the "teacher as researcher", and is considered to be practitioner-oriented and largely focused on school self-evaluation and review processes (Stoll & Sammons, 2007).

The gap between the two is widened by methodological differences and some have argued, ideological position (Harris & Bennett, 2004). School effectiveness research utilises large-scale

quantitative measurements of student outcomes across schools and localities, in contrast with school improvement research which focuses on processes, not outcomes, case studies, action research and studies that may more likely be qualitative in nature (Stoll & Sammons, 2007). Accountability processes, and the performance technologies that support this educational research promoting school improvement within the current context of performativity and neo-liberal governance (Ranson, 2003) largely focus on quantitative data. In recent times, the hegemony of quantitative data has gained ascendancy through international bodies such as the Organisation for Economic Cooperation and Development (OECD), International Association for the Evaluation of Educational Achievement (IEA) and the national educational agencies (Lawn, 2013b).

These research bases with their differing methodological approaches inform much of the policy interventions emanating from the UK and the US particularly. What is fundamental to both is the belief that school transformation is reliant on changing behaviour at an individual level. This requires schools to view themselves as learning organisations where agents (school members) identify and interact within the school context in order to motivate and direct individual teacher action (O'Day, 2002).

Within the data-school reform literature there is recognition that shifting school culture is multi-faceted and time-consuming requiring committed leaders with real understanding of the complexities (Earl & Katz, 2006; Sharratt & Fullan, 2012). Yet, school transformation appears to be very gradual despite what some have described as an inundation of data within the classroom. There is an underlying thread which argues that much of the data uptake is superficial and that while schools appear to be more motivated to enact data-informed practices, individually, teachers continue to rely on their own beliefs about "what data count and whether or how data use benefits students" (Mandinach & Jimerson, 2016, p. 453). This research positions the problem to rest with both the organisational processes and the value systems in place in a school, having less regard for different explanations of what might be influencing the dynamics of each school context.

Accordingly there should be rational interest and merit in developing more robust understandings of the characteristics of educational data work (Selwyn, 2015). While existing bodies of research have largely focused on governance, accountability and administrative potential, more recently, a technical, combined with a sociological, sensibility been called for (Kitchin, 2014; Selwyn, 2015; Williamson, 2016). This research argues for an unpacking of 'the black box' of digital data with a focus that begins with the view "that data is political in nature—loaded with values, interests and assumptions—that shape and limit what is done with it and by whom" acknowledging as well "that data are profoundly shap*ing* of, as well as shap*ed* by, social (and

agential) interests." (italics in original) (Selwyn, 2015, p. 69). An engagement with the structural and cultural conditions that are shaping or being shaped by agents interacting with data in schools presents an opportunity to consider the rise of data use from a socio-cultural perspective.

The next section focuses on emerging explanations of the processes of meaning-making and why social interactions with data might by constrained (or enabled) by the conditioning in place.

2.8   **The Sociological Life of Data**

The transformation of schools towards more data-driven school reform practices focuses on the way schools are organised and how members of the school community interact with each other around data. However, while external policies and interventions attempt to constitute what happens within schools, there is recognition that efforts to implement changes in data use do not necessarily recognise or take into account the culture and structures already in place (Hubbard et al., 2014; O'Day, 2002). Data-use routines (Kallemeyn, 2014; Volkoff, Strong, & Elmes, 2007), access to data (Coburn & Turner, 2011b), leadership (Datnow et al., 2017; Sharratt & Fullan, 2012; Spillane, 2012), norms of interaction (Earl & Timperley, 2008), data literacy and the unequal power relations that may emerge (Selwyn, 2015; Selwyn, 2016) are components of the organisational and political context that comprise a school.

Accordingly, some attention has focused on the existing relationships between the contextual conditions and the processes of data use in individual cases (Coburn & Turner, 2011b). Inside these theories of action (causal chains) are possible mechanisms that may or may not trigger practical changes; however, identifying which is most effective is poorly understood (Spillane, 2012). Research suggests that change at an organizational level and shifting teacher and administrator practice at an individual level together have the potential to enact reform (Coburn & Turner, 2011b). However, these contending theories and assumptions are often left unexamined in the rush for reform.

School responses to data are predicated in the understanding that data do not objectively guide school practices alone—it still remains with people to interact with data (Spillane, 2012) to make sense of it. This perspective argues that people bring agency to the processes of data use— they can notice or ignore data depending on their knowledge, beliefs, experiences, motivation and self-interest (Mandinach & Gummer, 2016; Mandinach & Jimerson, 2016; Selwyn, 2016). Acknowledging that teachers and administration actively negotiate data for different reasons and in different contexts directs attention to the sometimes negative or unexpected consequences of data use (Spillane, 2012). Regardless, what is evident is divergence in the social practices and processes

that take place around data use and sensemaking in schools. The form and outcome of these social practices are dependent on the type of routine or process that establishes the context for action.

Therefore, attention is turned to the way data-use routines, as part of each school day (meeting, noticing, measuring, categorising, interpreting and constructing implications), are situated as influential social practices (Selwyn, 2015). An organizational routine is defined here as a "repetitive, recognizable pattern of interdependent actions, involving multiple actors" (Feldman & Pentland, 2003, p.95). Data-use routines, therefore, are constructed as the modes and means, that teachers and administration staff interact with data and each other (Coburn & Turner, 2011b) and consequently have potential to change individual and group practice. Considering routines within the duality of structure and agency (Archer, 1995), Feldman and Pentland (2003) argue that "One part embodies the abstract idea of the routine (structure), while the other part consists of the actual performances of the routine by specific people, at specific times, in specific places (agency)" (p. 95). Rather than the emphasis being placed on the structure or repetitious nature of a routine, this focus on agency and reflection shifts a routine to a more dynamic framing. This view supports the understanding that the interaction between these two aspects becomes a potentially powerful means of change (or not). Regardless, as research has shown the action of "bringing together people and focussing and framing their attention" provides a "consequential context" for data use in schools (Coburn & Turner, 2011b, p. 182).

There are further dimensions that influence how these routines take place. One perspective focuses on how leadership and interaction with principals particularly, is an enduring theme. Leadership and leaders are seen as 'bridging' the gap between data and the teachers (Earl & Katz, 2006; Earl & Timperley, 2008; Sharratt & Fullan, 2012). Other perspectives highlight partnerships across schools—this approach relies on bringing internal/external experts and teachers together in collaborative activities focused on data practices. Yet another approach argues for intensive professional development of data skills in teachers and this is often combined with collaborative inquiry through interactions in data teams (Mandinach & Jimerson, 2016).

Additional elements indicate that time, or too little time, impact the quality of interactions around data (Earl & Timperley, 2008). This is particularly pertinent when the amount of data that schools have access to and/or generate themselves is rapidly rising (Lawn, 2013a; Selwyn, 2015; Selwyn, 2016). Another perspective discussed in a previous section is access to data. Research has shown that data access is a function of many complex interacting elements; technological, human and organisational infrastructures all work to shape the flow of data to groups and individuals (Anagnostopoulos et al., 2013; Daly, 2012; Daly & Finnigan, 2012). Highlighted here is that these

data routines and processes all take place within multi-layered contexts of power and authority (Anagnostopoulos et al., 2013; Hardy & Lewis, 2016; Sellar, 2014, 2015; Selwyn, 2016). Accordingly, this developing knowledge base returns to accountability, and the role power and authority play in data-use routines and sense-making processes.

Each of these perspectives furnishes another facet to the complex framework that is at the centre of how data use evolves in schools. While models differ (see Earl and Timperley, (2008); Coburn and Turner, (2011)) what is common are the complex, multiple-layered data routines and interactions that occur in school contexts. What is also apparent is that these interactions are contested sites that bring tensions and challenges to the way data are used in schools. As Mandinach and Jimerson (2016) have noted, "a recognition that data use is not an inherent good, but that it must be implemented in ways that are ethical and which treat data use as a means to an end, rather than an end in and of itself" (p. 436). Determining the 'good' in data-use routines is positioned as challenging for reasons that rest in understanding when, and under what conditions data use primarily serves the requirement of students (Mandinach & Jimerson, 2016). And while there is continuing interest in this research base, there exists some fundamental contradictions in how the purpose of data-use routines and sensemaking is conceptualised.

Teasing out these conditions of data use is central to discussion and debate; however, what appears to be less visible is the understanding of what constitutes data use. Establishing the causal links between data-use routines and sensemaking and improved school outcomes is a work in progress, and while Earl and Timperley (2008) assert that "significant change in schools depends on the creation of new knowledge for the adults who are making the decisions"(p. 2), this specification does not encompass the myriad of methods by which this might occur. Nor does it consider the power relations that may be situated in these interactions. Consequently, determining the conditions that may be driving school reform complicates any research aspirations.

2.9   Moving Toward a Theory of Education – Underlabouring the Knowledge Base

This examination of data use in education research exposes several underlying tensions in the knowledge bases. The rise of data-informed accountability draws attention to the relationships emergent from the practices and processes of data use at the school level and within individual classrooms. Here Biesta (2004) considers what kinds of relationships are made possible by a culture of data-informed accountability and the converse, what kinds of relationships are made *impossible* by the same culture. A second issue highlighted was the contested nature of school effectiveness and school improvement research bases in turn drawn on by governments and education sectors to shape data policy and governance driving school reform. Third, is a fundamental concern for the

paucity of new research concentrating on the politics of data and the apprehensions and issues likely to arise from power inequality and control in educational spaces. Finally, considering these emergent relationships directs attention to the data routines and sensemaking processes that are thought to influence outcomes at a school level. Accordingly, while these research phenomena are potentially aligned around data use in schools, there remains a crucial lack of clarity as to how they might be examined.

Hence, the comprehensive yet fragmented knowledge base/s informing data-use practices presents schools (and the researcher) with a paradox. Emerging theories and knowledge position data by turn: as numbers, as a source of truth, as competition, as institutional reform, as governance and accountability alongside the risks associated with data use (Milan & Van der Velden, 2016). The social dimension of knowledge construction and choices and the types of knowledge considered important by different groups should be accounted for. Here, knowledge of the phenomenon draws from a number of fields not necessarily education-based which in turn attract a range of rival theoretical perspectives (Gable, 2011). It is assumed that schools and teachers will be able to negotiate their way through the multiple perspectives and key dimensions that crowd this space in order to recognise the data policies, processes and practices that will lead to better outcomes for students through a form of teacher data agency.

Accordingly, Anagnostopoulos et al. (2013) argue that understanding "the interplay of the cultural authority of numbers and the local narratives of schooling in which those numbers take on meaning and get taken up into practice", requires an infrastructural, and I would add, a socio-cultural perspective of "the space between performance metrics and practice" that can provide insight into the value creation process and types of interactions that make individual and group meaning of data (p. 401). It is noted here that the increased and more individualised denser patterns of data availability combined with cultures of accountability are likely to support more intensified relationships (Lycett, 2013). Exposing the social relations emergent from these interactions is therefore likely to provide insight into the research problem.

Yet the nascent and conflicting nature of the research bases concerning the new ways of knowing afforded by new forms of data present problems for the researcher. Researching a phenomenon which is characterised by a series of competing positions operating in an open system requires a set of characteristics that might generate this environment and the relations between (Scott & Bhaskar, 2015). Here, a distinction needs to made between questions of knowledge and action (e.g., the contested space between performance metrics and practice) and what the world is really like for these to be the case (Joseph, 2002). What is required is an application of philosophy

that supplies, both a framework for an assessment of the social processes of knowledge production and the analytic separation of the knowledge base/s from the research phenomenon under enquiry (Gable, 2011).

CR as a process of underlabouring holds the potential of applying philosophy to 'clear away' or discard less acceptable ideas and to then direct researcher attention to more likely explanations, the emphasis being on "the more positive side of this, that is, with delineating the general contours of the world at an abstract level" (Bhaskar & Hartwig, 2010, p. 203). Here it is argued, … "the outcome of the underlabouring process is that domain-specific theory can be constructed from the process after the existing theories have been critiqued and the inconsistent features removed" (Wallace, 2012, p. 61). Therefore, the strength of a CR approach lies in its discriminatory capacity to uncover methodological risks and faults that may lie in social science research and to search out better and clearer research pathways (Lawson, 1998).

CR operates as an underlying 'intervention' supporting a process that can clarify and shape the research process. Here, critical realist underlabouring arguments might be used for several purposes. In one circumstance, to support an educational theory under attack from positivist assumptions likely to undermine the emancipatory potential, or in another, move to criticise some of the ontological or epistemological premises of an existing educational theory or theories (Collier, 1994). This ground-clearing is a balancing act that navigates between different philosophical positions in the search for explanatory purchase. This is made possible by considering the "ties that bind ontology and methodology together" making explicit the role of ontology in this practical social theorising (Archer, 1995, p. 29). In this respect, underlabouring as a form of ontological reflection acts a regulator outlining, even excluding some of the research possibilities (Archer et al., 1999) while the process of retroduction serves as the means to isolate and describe conditions (mechanisms) for the events and phenomena being studied. The process of retroduction is seen as a movement "from one thing (empirical observation of events) …to something different (a conceptualisation of transfactual conditions)" (Danermark et al., 2002, p. 96). Accordingly, the philosophical tools of CR are here considered integral to defining the object of study for this explanatory research project.

Yet, any conceptualisations of social reality constitute a risky business and are likely to be flawed, as Archer (1995) argues, "What social reality is held to *be* also *is* that which we seek to explain." (p. 17). Engaging in research is inherently a social process and the novice researcher is particularly at risk here where there is always potential to overreach one's empirical claims and judgements within the underlabouring process in framing the research study. Archer et al. (1999)

make the comment that "For realist philosophy to really have methodological consequences, the link between the posited abstract ontology and the shape and texture of the research findings must be systematic and explicit" (p. 15). To counter any concerns, a six-stage process of explanatory theory building makes the underlabouring process a transparent exercise, tracing development of the research project from conceptual framing through to data collection and analysis (Danermark et al., 2002).

This explanatory model for social research draws on six stages which move through description, analytical resolution, theoretical redescription, retroduction, comparison, and concretization and contextualization (see Sections 3.5 and 4.3). Yet, as Shipway (2011) notes, utilising "a stratified, emergent, and non-linear philosophy" (p. 58) in a linear fashion is neither appropriate and nor, it should be noted, is encouraged by the authors of such models who argue that the stages are more like guidelines and different activities can be foregrounded at different stages of the research (Danermark et al., 2002). The next chapter demonstrates both the utility of the explanatory model and the philosophical underlabouring capacity as it moves through a process that seeks to identify and isolate objects of knowledge likely to support a more robust explanatory purchase.

2.10 **Summary**

This chapter has described some of the contemporary challenges concerning data facing teachers in this century. This synthesis of educational literature was presented with the view to finding an entry point into the research space of this study. The research task sought to explain school responses to new uses of data in contemporary education systems. The high-level scan of literature revealed broad understandings of the shifts in this field and their collective places as part of larger social structures. The rise of a new audit culture presaged a shift in governance in schools. It was proposed that new data accountabilities were likely to change the nature of relationships both internal and external to schools. The new cognitive educational spaces that data have created were examined in an epistemological sense considering how new ways of knowing might transform social relationships.

These conflicting knowledge bases did not recommend a clear-cut theoretical choice. Nor did describing the complex landscape of interrelated organisational and political contexts, the data use processes, and the emergent social relations elicit an obvious methodological solution. Bhaskar (1989a) argues that the tensions and contradictions in knowledge bases are likely to have real social effects; consequently, CR and the underlabouring process specify the means to navigate these tensions by carrying out the ground clearing necessary to make better and more informed use of

knowledge. It was therefore proposed that the CR process of underlabouring in conjunction with a six-stage explanatory model of research might provide methodological direction. With this is mind, the next chapter describes this initial research process.

3. Critical Realism and the Underlabouring Role

3.1 **Introduction**

This chapter argues that characteristics of CR meta-theory provide a substantial base for the investigation of complex educational phenomena. The first section expands on this claim by exploring what critical realism (CR) is and how the underlabouring role it can assume supports this argument. It describes some fundamental critical realist premises and provides detailed explanations of how this conceptual framing relates to this doctoral research project. The chapter begins the important process of refining the research process using a critical realist tool kit.

The second section expands this toolkit and introduces conceptual resources supportive of the specific research task. Description, analytical resolution and abduction/theoretical redescription comprise three stages of a six-stage explanatory model of social science, which further refines the object of study. Each of these stages provides an opportunity to critically examine the social phenomena in a process that moves from the concrete to the abstract, and then back again. The final section draws together these resources and sets out an approach that includes Archer's morphogenetic model, with its prospect of understanding the elaboration and/or reproduction of structure, culture and agency over time.

This chapter presents the critical realist framework adopted and used in this study. Here the aim is to confirm the utility of critical realism (CR) as a philosophical underlabourer (Bhaskar, 1989b). In this respect, the preliminary methodological work, that is, the ground-clearing for the research is performed by CR in attempt to reduce or remove some of the complexities and inconsistencies standing in the way towards knowledge. This initial stage is the beginning of the long-term relationship between CR as a meta-theory and the empirical research methods of this study that explore the effects of new uses of data in schools.

This relationship relies on two premises: first, that educational (or any other) empirical research methods need to be underpinned by a meta-theory, such as critical realism (Scott, 2013). The second premise relies on the conception that "the empirical world cannot constitute the totality of the social world" (Scott & Bhaskar, 2015, p. 62). This does not commit the researcher to necessarily understanding this independent reality—just recognising that it is there is sufficient to begin with (Scott, 2013). This is a matter of sequencing in CR where an ontological theory presupposing an epistemological theory has an ongoing influence on how data are collected and analysed. This acknowledges the continuing relationship that CR has with any future methodological decisions made in this research. In this respect, the first task of CR as underlabourer

is to identify and remove methodological obstacles in order to identify an entry point into the research phenomenon.

3.2   Contemporary Approaches to Researching Education

The dramatic rise of data use in educational contexts mirrors its rise in other parts of society; however, as the previous review of literature indicates, it is a complex space, complicated by several factors. How schools are expected to negotiate new governance and community expectations constituted by new forms of data is a key challenge in the drive for school reform. Contemporary education knowledge bases reflect diverse research paradigms where the various theoretical positions present schools with daily dilemmas to negotiate.

New ways of thinking about data i.e., datafication and the accompanying research constitute issues for teachers and administration staff in schools. How research can assist schools make sense of these often-conflicting perspectives requires reassessing traditional research approaches where the emphasis is likely to rest on empirical outcomes. The application of philosophy can work here to identify and separate the various components and the relations between them. By drawing the distinction between the world of knowing and the world of being, Bhaskar argues for a social world that is stratified, where different interacting relations/mechanisms are likely to have different effects across different levels (Scott & Bhaskar, 2015). In this respect seeking knowledge of this new data-based social world requires investigating social phenomena across any number of levels to identify underlying causal mechanisms and processes (Carter & New, 2004b). Explaining the new patterns of data interactions and phenomena might be made possible by revealing what causal processes are operating at different levels of this social world.

This stratified understanding of the social world supports the concept of emergence "where two or more objects can give rise to a new phenomenon that cannot be reduced to the properties of the original objects" (Case, 2013, p. 39). Accordingly, this situates the relationship between structure and agency as both a "key framing device at the ontological level" (Scott & Bhaskar, 2015, p. 62) and a central dilemma of social theory (Archer, 1995). It also treats structure and agency, as independently owning properties and powers that affect each other (Case, 2013). Therefore, interesting things, but not necessarily predictable outcomes, happen when structural and agential objects interact. Exploring the interaction between structure and agency promises valuable insight into the research phenomenon given the complex and multiple structures, the numerous stakeholders and the constant focus on improvement and accountability that occupy data use in schools (Rigby, Woulfin, & März, 2016).

These ontological framing devices inhabit the assumption that it is possible to ask the question "what must the social world be like then for this phenomenon to be possible?". They also suggest that "any description of the world is both explanatory within a particular set of conceptual relations and potentially transformative of those relations" (Scott & Bhaskar, 2015, p. 62). This acknowledges that education as a social practice takes place in a non-linear, open system and as Sayer (2000) comments, is "usually complex and messy" (p. 19). Traditional positivist approaches to educational research which seek to replicate the controlled conditions of a laboratory in the classroom are not likely to account for this absence of closure. It follows that methodologies that isolate and control variables, observe individual phenomena and draw understanding from the Humean understanding of the constant conjunction of cause and effect may not capture the untidiness of this social reality (Shipway, 2011). Recognising the open nature of the education context frees the researcher to explain rather than predict the different ways agents, in this case, teachers might interpret the material conditions and contexts they inhabit (Sayer, 1992).

Accordingly, an approach that offers the opportunity to align uneasy research bases, that recognises the complexities of researching in open systems and that focuses on exposing the structures that can affect agents in educational settings is crucial. CR provides a functional meta-theoretical base which has the potential to support the researcher in these endeavours. The founder of CR, Roy Bhaskar signals his intentions with an important question:

> What properties do societies possess that might make them possible objects of knowledge for us? My strategy in developing an answer to this question will be effectively based on a pincer movement. But in deploying the pincer I shall concentrate first on the ontological question of the properties that societies possess, before shifting to the epistemological question of how these properties make them possible objects of knowledge for us. This is not an arbitrary order of development. It reflects the condition that, for transcendental realism[6], it is the nature of objects that

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[6] The term 'critical realism' emerges from the synthesis of Bhaskar's terminology: transcendental *realist* and *critical* naturalist (Fleetwood and Ackroyd 2004). "Bhaskar's 'critical realism' is an elision of two earlier conceptions, one for science (transcendental realism) and one for the human sciences (critical naturalism) (1989). He describes his philosophy of science as "transcendental realism" (1978): a variety of scientific realism which sees science as explanatory of a structured, differentiated and changing world. This position is 'transcendental' in that, as a philosophy, it treats the self-same world as the sciences, but does so transcendentally: from the perspective of what such scientific practices presuppose about the world (1978")" (Corson, 1991, p.223) …"Alongside his philosophy of science, he describes his special philosophy of the human sciences as "critical naturalism": an account of the human sciences which sustains the idea of an explanatory critique of specific structural sources of determination and their emancipatory transformation" (1979) (Corson, 1991a, pp. 223-224).

determines their cognitive possibilities for us; that, in nature, it is humanity that is contingent and knowledge, so to speak, accidental.

(Bhaskar, 1989a, p 25)

Here, Bhaskar offers a set of guiding questions for research possibilities. The arrangement is most important in this research because of "the close relationship between social theory and society (theory attempts to explain society while also being the product of it)", and the tensions and confusions which might exist within social science and theory (Joseph, 2002, p. 25). While the nature of the social and its conceptual aspect do become intertwined, CR as an underlabourer has the means to separate or distance itself from the social analysis at hand (Joseph, 2002). In this respect the researcher can 'step back' from the research phenomenon and assess the knowledge claims of each research base from a critical realist ontology. CR affords such distance providing perspective and clarity on what might be important and what can be considered ideological when developing a framework for review and analysis. This is critically important in the contested space of educational research on data use where the lines are being constantly being drawn (and redrawn) between several research and ideological positions.

Accordingly, this philosophical model offers the opportunity to underlabour for the researcher, drawing critically on Bhaskar's understanding that there is potential within the critical realism toolbox to reduce and define objects of knowledge in complex educational environments (Bhaskar et al., 2017). Examining the differing theories of knowledge that guide data use and school improvement and accountability policies from this perspective promises to shed light on the limits of knowledge and then direct the researcher to knowledge that is more trustworthy. The next section begins this process with CR as an underlabourer and moves to a much more applied version—a CR in practice (Price & Martin, 2018).

3.3   Critical Realism as Social Ontology

The identification of critical realism as a social ontology that operates as an 'underlabourer' rather than 'master builder' is a critical part of this research journey (Cruickshank, 2003). The previous chapter outlined the difficulties of isolating objects of knowledge in a series of complex literature bases and multiple shifting perspectives. This is not unusual in the social world where Carter and New (2004b) argue "the complexities of human ambition, desire, interests and relationships are such that social relations could never be reduced to a set of unchanging generalisations" (p. 1). Underlabouring is "giving an account of how the world works at the level of the real; a level which lies behind directly experienceable appearances" (Dean, 2011, p. 402)

offering an opportunity for conceptual clarification and the removal of methodological obstacles. There is the potential to improve the researcher's capacity for reflexivity, to make sense of the world in a practical and relevant way (Bhaskar et al., 2017)**.**

Critical realism supports the researcher in understanding the limits of knowledge by arguing for the separateness (distinction) of the world *and* the knowledge we, as people have of the world (Joseph, 2002, p. 28). The outcome of this way of thinking about the world is looking beyond knowledge and action and seeing that there is more to it than that. The CR position is therefore considered "the *ontologically least restrictive perspective"* because it is inclusive of causal levels of reality and can also "accommodate the insights of other metatheoretical perspectives" (Bhaskar & Danermark, 2006, p. 294). Engaging with critical realism involves taking up the knowledge that I already have about data use in schools and reinterpreting it in realist terms (Case, 2013).

Adopting critical realism means thinking about the world in a particular way. As Bhaskar (1978b) explains:

> Social products, antecedently established knowledges capable of functioning as the transitive objectives of new knowledges, are used to explore the unknown (but knowable) intransitive structure of the world. Knowledge of B is produced by means of Knowledge of A, but both items of knowledge exist only in thought.

> (p. 23)

Bhaskar's (2008) understanding of this social world relies on conceiving the intransitive realm as an independent reality in contrast with the transitive realm which attempts to understand or explain it (Joseph, 2002). These two sides of knowledge, one socially produced knowledge existing in our minds, and the other which is understood as a philosophical ontology where knowledge obtained is independent of people, form the basis of an openly ontological standpoint. How we can reconcile this understanding in the natural sciences is clearer, compared to when it is applied to the social sciences, where the objects of social science knowledge are, by necessity, social products to begin with and influenced by different social mechanisms (Danermark et al., 2002).

Consequently, critical realism supports a thought process that recognises the confines of knowledge—here the realist can think past interpretative methods to focus on causal explanations (Case, 2013). It also assists in the resolution of the structure-agency problem by explaining how social reality enables and constrains individual agency and what social relationships are emergent on the basis of their interaction (Carter & New, 2004b). In this respect, the performative nature of new data uses might be exposed in the emergence of new accountability relationships in schools.

This is the basis of critical realism's social agenda of emancipation where "supported by the philosophical purpose of critical realism…its task is to expose and remove ideological obstacles and inconsistencies" (Shipway, 2011, p. 54).

Accordingly, a philosophical perspective that facilitates a stratified ontology adds a critically important factor to education research offering the means to think about education across multilayered contexts. Research seeking to make better sense of education and data is centred on revealing the social relations of data usage that might be established, reinforced or eliminated if data is to drive school improvement and accountabilities, and emerging forms of teacher data agency. It also has something to say about structural influences and their causal efficacy in educational settings. The next section expands on the critical realist understanding of the social world and is concerned with the educational implications of CR in research settings. It considers the unique position that CR might hold in undertaking educational research that is characterised by long standing dualisms (Shipway, 2011).

3.4 **Real, Actual and Empirical Domains**

By revealing how the social world is structured, a CR view of the world is supportive of research examining complex phenomena such as education systems. Joseph (2002) summarises this emergent world of structures, each with their own irreducible properties and powers:

> Critical realism argues that the social world, like the natural world is comprised of a series of structures and generative mechanisms combined with a number of organised human practices and understandings. In contrast to mechanical materialism, it argues that these structures form a stratified differentiated totality. Different layers overlap, mutually co-determine and complement or contradict each other.

> (p. 30)

Furthermore, Shipway (2011) argues that examining a phenomenon in terms of a stratified reality, repositions opposing viewpoints as "*concerns which relate to the various domains of reality*" (p. 140 italics in original). We see this at work when we try to make sense of the role of the Minister for Education in the initiation of the Education Revolution or indeed the members of the Council of Australian Governments (COAG) in this process. Any discussion about potential power and the wielding of that power at this level of government presupposes irreducible social structures at work. The dynamic relationships between the Australian Federal and separate State government systems, and their respective education systems can be examined in a non-reductive way.

To support this claim for 'depth realism' and the stratified nature of reality, Bhaskar makes a series of transcendental arguments for three domains: the real, the actual and the empirical (see Table 3.1). Firstly, the real is whatever exists, social or natural, whether we recognise it or not or even have some understanding of it (Sayer, 2000). It is the province of objects, their structures and powers. These objects can be physical or social. They have particular structures and causal powers, they have the potential, the facility to behave in certain ways and they can bring about changes, recognised or unrecognised. To extend the previous example, the position of Minister for Education (the Education Revolution 2008) holds substantial powers that belong in the realm of the real. These are hidden mechanisms enabled by human agency, within a framework of impersonal social relations, yet we know they are real because of their causal efficacy (Willmott, 2002). It is in the activating of these powers that we enter the domain of the actual. What happens if and when these powers are exercised is also determined by other mechanisms that may also be actuated and intervene, setting off an alternative series of happenings at the level of events (Collier, 1994).

Table 3.1: Stratified nature of reality: Three strata - Real, Actual and Empirical (from Bhaskar, 1978a, p. 13)

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanisms	✓		
Events	✓	✓	
Experiences	✓	✓	✓

To further support this idea, agents (in our case, teachers) do not necessarily experience these events as predicted. This is the realm of the empirical, the domain of experience in which we experience something directly or indirectly. Therefore, the level/domain of the empirical refers to subjective experiences, the level of the actual, objective observations while the level of the real is about the mechanisms that underpin what happens at the level of the actual and the empirical (Case, 2013). Accordingly, the research process begins in collecting data from the domain of the empirical, while data analysis takes place in the domains of the actual and real. Here the research aim is to identify operating mechanisms and explain their impact on teachers.

All three realms are real, yet the empirical domain which is supposed to be more "real" by some definitions is always theory laden. All data that we have or understand comes through connection with some or other theory; consequently, we do not experience these events in a direct way, they are always mediated by our theoretical frameworks (Danermark et al., 2002). Therefore, every effort must be made to not fold the three domains into the empirical, that which we can observe. Bhaskar's key criticism of positivism is that it conflates the experience of the domain of the empirical with what happens in the actual and the real. Keeping the three domains distinct

supports the possibility of explaining the existence of unobservable things by referencing observable effects which can only be explained by the products of these things (Sayer, 2000). In other words, we look for patterns of events in the domains of the *empirical* and *actual* that indicate mechanisms that we cannot see in the *real*; however, we infer that they are there because of their effects.

Acknowledging a depth ontology, the separation of the real, the actual and the empirical suggests that things can happen without witnesses or without agents being aware of them. For example, consider the powers held within the position of the federal Education Minister. These powers may remain unexercised or exercised and not identified because they may be countered by other mechanisms. Alternatively, they may be exercised and yet remain undetected because other mechanisms are thought to be responsible for particular outcomes (after Willmott, 2002). The consequences of this is that we may make observations about the structures that might influence how a school and individual teachers respond to new data-use mechanisms; however, some structures may not be observable. The structures we seek may not be easily identifiable from patterned empirical events and having their own causal abilities and liabilities means they can catalyse, block or modify possible actions (Sayer, 2000) which further complicates the explanatory possibilities.

Furthermore, research outcomes rely on a methodology that can investigate beyond the level of events in each of the case studies to expose the obscured structures and mechanisms that are influential in school contexts. For example, teachers of a school may be called to a meeting to listen to an account of NAPLAN results by the principal. They may not be aware that the agenda for the meeting has been prepared earlier by the principal in consultation with the Assistant Regional Director-School Performance (ARD-SP) and the outcome of the meeting is 'data expectations', a targeted set of improved results. The teachers are unaware of the exercise of power by the ARD-SP and the possible ongoing effects this has on the principal's positional powers (Willmott, 2002). Asking questions that may expose these events at the actual exposes the possible explanatory power of critical realism.

Critical realism advances a depth ontology which might expose causal properties, yet there is inherent difficulty in determining the exercise of causal powers at the event level. What strengthens this claim is the phenomenon of emergence where the combined properties of one stratum have the potential to form an object in another stratum with new properties which are not reducible to the properties held in the previous stratum (Bhaskar et al., 2017). Sayer argues that "Emergence can be explained in terms of the distinction between internal and external relations.

Where objects are externally or contingently related, they do not modify one another's causal powers and mechanisms, although they may interfere with the exercise of these powers" (1992, p. 119). Additionally, Danermark et al. (2002) reason:

> …if the relation is internal and necessary, in other words, the objects depend on upon one another for their existence, as in the case with social relations such as (principal/teacher) then emergent powers ensue, since precisely this combination of individuals in a decisive way determines the powers they exercise on each other.
>
> (2002, p. 64)

There is nothing linear about these social relations; we cannot assume because of what we observe in the actual and the empirical domains is in fact due to mechanisms in the real. There is no direct cause and effect that can be adduced when building these chains of emergent causality in a depth ontology. Consequently, the concept of emergence where particular groupings of things, processes and practices in social life commonly give rise to new emergent properties is a powerful tool in the critical realist tool box (Carter & New, 2004). As such, these arrangements are more than the sum of the previous arrangements. Consequently, they have the potential power to alter these elements. This ability of emergent properties to modify the powers of constituents is important in research seeking causality and causal explanations. These causal explanations therefore are not reliant on knowledge claims that dwell only in the empirical, where causality for some is based upon associations between variables and measurement of some kind (Scott, 2013).

Returning to the analogy of the critical realism toolbox, there are now the means to move to the work of explaining some of the "lived realities" (Scott, 2013, p. 91) of teachers negotiating the new terrain of data use in education. To summarise these understandings, critical realism notes that structural objects are independent and real and have consequences for agential action. A depth ontology allows for the stratification of the world which supports mechanisms within different strata of reality operating and/or cooperating to produce events—concrete or otherwise (Danermark et al., 2002). Finally, the concept of emergence strengthens the critical realist claim of explanatory purchase by arguing the possibility of identifying chains of emergent causality (Case, 2013).

Accordingly, to develop these sequences of causal happenings requires a methodological understanding of the relationships between possible objects of knowledge (Scott, 2013). The starting point for the researcher is looking for and establishing the series of causal relationships and the ways they connect; in effect, what generative social mechanisms are at work in each context (O'Mahoney & Vincent, 2014). This explanatory model is a process of theorising that potentially

"attains knowledge of constitutive qualities and causal mechanisms generating events, but also knowledge of how different mechanisms cooperate and, under specific circumstances contribute to concrete events and processes" (Danermark et al., 2002, p. 108). The practical outcome of this process is examining the terms of references that exist for current perspectives of a research topic and then, using the critical realist toolbox, to develop new terms of reference that overcome these identified issues.

3.5   An Explanatory Framework of Social Science

In seeking knowledge of how different mechanisms might contribute (through interaction) to concrete educational events and processes, a CR-informed six-stage explanatory model has been adopted (Danermark et al., 2002). These guidelines support a research practice that moves between the concrete and the abstract providing two different forms of knowledge about reality, neither of which can be reduced to the other. This explanatory process begins in the concrete with descriptions of the research issue, before moving through the initial stages to a redescription of the research project resulting in the original objects of study being located in a new context of ideas (Danermark et al., 2002). Within this space, there is an opportunity to problematise current thinking and redirect attention to alternative ways of thinking about a research problem (Alvesson & Sandberg, 2013). These theoretical and methodological perspectives provide the basis for interrogating school responses to new data initiatives in relation to the structural and cultural conditioning that enables or constrains teacher agency in diverse contexts.

The next section employs the process to the initial problem posed; that of complex knowledge bases and potentially aligned, yet inconsistent positions, complicated by the open nature of educational systems, to reduce and define the potential objects of knowledge in this study. This process involves the researcher moving from the concrete to the abstract and then returning to the concrete. It includes up to six stages summarised in Figure 3.1 (Danermark et al., 2002).

While Danermark et al. (2002) describe each step as a stage, they make it clear that these are only guidelines and that the individual is free to switch between stages when necessary. A strict chronological order is not essential. The model or set of principles begins in the concrete stage and involves the explication of events, including the description of everyday concepts. The second stage involves the explication of structure and context, and the distinguishing of different components or dimensions. The third stage is the abduction and theoretical redescription of these different components and the connection with the various theories around structure and social relations.

The fourth stage, essential to CR, is the retroduction stage, here defined as "a form of inference that seeks the CR goal of explaining by identifying and verifying the existence of a set of mechanisms which are theorized to have generated the phenomena under study" (Wynn & Williams, 2012, p. 799). The fourth stage is the active and creative stage of the research process where explicit use of the earlier strategies asks specific questions of the research data in the search for explanation. The fifth stage seeks empirical substantiation by comparing the proposed theories and the data collected. In this stage, the explanatory powers of the proposed mechanisms and structures are assessed against each other (Danermark et al., 2002).
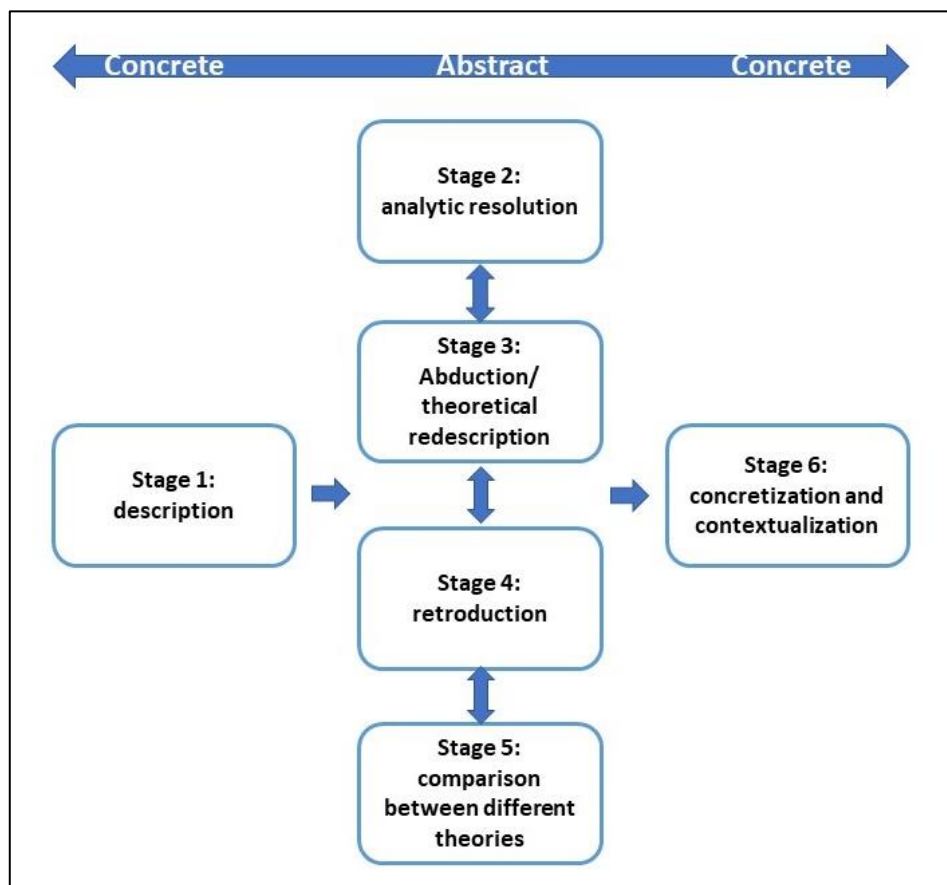
Figure 3.1: A CR Explanatory Model of Social Science Danermark et al. (2002) (adapted from Raduescu & Vessey, 2008, p. 20)

The final stage is what Danermark et al. (2002) describe as the concretization and contextualization stage and supports the idea that the use of multi-methods is necessary (Wynn & Williams, 2012), particularly in applied social science. This substantiation of the different mechanisms and structures as they exist in context is important for examining how each mechanism interacts with other mechanisms on different levels. Thus, as Danermark et al. comment, "The aim of these studies is twofold: first, to interpret the meanings of these mechanisms as they come into

view in a certain context; second, to contribute to explanations of concrete events and processes" (2002, pp. 110-111).

The first three stages (description, analytic resolution, and theoretical redescription) will be employed in this chapter to narrow the broad field of the research phenomenon to something examinable. New terms of reference are established, and a preliminary set of research questions will be posed. The latter stages will be deployed in the analysis sections in Chapter 5/6/7 with a further explanation of the benefits of retroduction, a key methodological tool in the critical realist toolkit.

3.6 Stage 1: Description of Events

The first stage of the explanatory process begins in the concrete and the task is to describe the research problem from the perspective of the everyday. This stage identifies the various components of the research focus and identifies the conditions in which they align and diverge.

This research focused on how teachers are negotiating the space that new ways of knowing data has created in schools. The original literature review highlighted a complicated landscape of conflicting trends: in accountability in schools, data use and datafication, school improvement research and social interaction and change in schools. This broad focus revealed influences in accountability from the rise of an audit culture (Power, 1994, 1997, 2000), a neoliberal and global imaginary in educational policy development (Ball, 1998, 2008; Biesta, 2004; Ozga, Lingard, Lingard, & Ozga, 2007; Rizvi & Lingard, 2010), new emphases on accountability in education (Poulson, 1996; Ranson, 2003, 2008; Webb, 2005, 2006, 2011) and new relations of accountability (Biesta, 2009b, 2010; Biesta, 2004; O'Day, 2002). The concentration on school improvement raised concerns of government appropriating education research to validate new data policies. The rise of data use in education was reconceptualised through the lens of datafication which identifies new ways of understanding the world through data (Lawn, 2013a; Lycett, 2013; Roberts-Holmes & Bradbury, 2016; Thompson, 2016; Williamson, 2018), a macro- and micro-relational understanding of data use (Selwyn, 2015; Selwyn, 2016), and how data makes things knowable, and therefore, actionable (Milan & Van der Velden, 2016; Sellar, 2014, 2015; Williamson, 2016). A scan of data use in education indicated how the new ways of knowing schools through data is changing; for example, school management processes (Coburn & Turner, 2011a; Coburn & Turner, 2011b, 2012; Selwyn, 2016; Turner & Coburn, 2012), leadership approaches (Earl, 2008; Earl & Katz, 2006), and professional learning and relationships around data use (Farrell & Marsh, 2016; Marsh, Bertrand, & Huguet, 2015).

This review directed attention to how school improvement processes and modes of accountability continue to operate in a complex space that is further complicated by datafication and new ways of knowing schools. Accordingly, the research space begins to take shape; however, clearly defined objects of research remain unclear.

This initial description made some headway to refining the research position while avoiding a reductionist approach in which "the explanation for the behaviour of concrete (that is many-sided) objects," is sought "by reducing them wholly to (or reading off from) just one of their abstract (that is, one-sided) constituents" (Sayer, 2000, p. 89). However, there are still too many focal points to account for in the search for causality. Further attention was directed to the research problem and how these positions might align or diverge. One possible direction was to consider the causal powers that are located in the social relationships that people build (Danermark et al., 2002)

The earlier review noted the types of relationships that accountability enabled and constrained in schools and elsewhere (Biesta, 2004). Further questions asked what we can know from data, what relationships can we have with data, and how can we make sense of data (Selwyn, 2015; Williamson, 2016). Another observation was that data use in schools is a social process and one that relies on relations and interaction with and around data (Coburn & Turner, 2011b; Earl & Timperley, 2008; Hubbard et al., 2014). Lastly, there was also the reflection that school improvement relies on the interactions and relationship building at a school and classroom level (O'Day, 2002; Wayman & Stringfield, 2006). Accordingly, school change is conceptualised as a matter of individual and group action that is shaped by social interaction and relationships. Therefore, these different social practices and interactions around data use are posited as a starting point for this research project.

Abstracting social interactions as possible objects of knowledge returns the focus to the underlabouring potential of critical realism. Abstraction in critical realism draws attention to "certain objects of something to the (momentary) neglect of others. It is a process of focussing on some feature(s) of some thing(s) while others remain in the background" (Sayer, 1998, p. 170). In this, abstraction is a tool used by critical realists in the first stages of research and also later during analysis to highlight the influential mechanisms (Sayer, 1998). It should be noted here that the process of abstraction occurs in many forms of social science research; however, it often takes place with less acknowledgement than in critical realism. What is recognised here is that once engaged in the process, the researcher understands that a particular vantage point has been assumed, a level of generality employed, and the scope or extension of the research needs to circumscribed according to what is researched (Sayer, 1998). The researcher is obliged to be reflective upon her place, here

insight and her judgement in the research process. This position will be discussed further in Chapters 4 and 7.

In critical realist terms, "abstractions concern the level of the '*real*'—causal powers or generative mechanisms; concrete concern the level of the '*actual*'—the effects, operation and activation of mechanisms. It is then contingent whether these are possible *empirical* objects for us" (Sayer, 2013, p. 128). Using the critical realist tool kit, we can refine earlier understandings of the types of social relationships that may be causally efficacious. Positioning these social relations in an ontologically real space recognises their power to mediate at the level of the actual and empirical. However, it does not make them any more knowable. In other words, the researcher's task is to look to the events in the actual and the empirical to determine what sets of social relations (structures) might be operating in the real. This critical realist model is conceived as a starting point for further research. What follows is how this model might look in practice.

Describing the fundamental challenges of multiple accountabilities not as dichotomies but as the "pushes" and "pulls" of accountability enactments (Vidovich, 2009) gives a sense of the contradictory tensions in policy and practices (see Figure 3.2) while articulating some of the pressure points for staff in schools. Yet, how staff respond (or do not respond) to these processes is not entirely obvious. Clearly, finding some links between the hidden mechanisms and structures of accountability and actual school and teacher responses will begin the explanatory task.
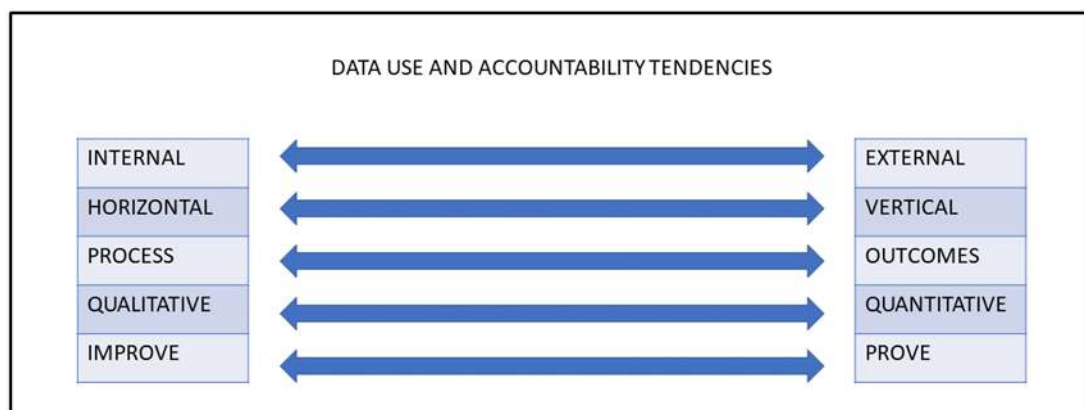
Figure 3.2: Tensions in accountability policies and practices (from Vidovich, 2009, p. 560)

Accountability processes tend to rely on the premise that improving the functioning of the school organisation will improve student outcomes (O'Day, 2002). These processes might consist of target setting of performance (improved spelling scores in NAPLAN across the school) and some assistance (and possible consequences) to meet set objectives. The school is then required to make

changes that will see improved outcomes for the student. However, focussing on the school organisation as a unit of governance foregrounds several issues.

Firstly, top-down accountability and governance processes are designed to generate improvement at the school level. Consequently, the school is seen as the unit of intervention. However, for actual changes to occur, it is the individual that is the unit of action (O'Day, 2002). This means that it remains the responsibility of individual teachers and administrative staff to make changes to what they do, (together and individually) with the expectation that it will change what students do to improve their learning. Thinking about how schools operate from a critical realist perspective requires thinking of them as operating within and across multiple levels (Sellar, 2017). Even as individuals operate at the school level, schools are nested in increasingly larger systems and environments that shape their work (O'Day, 2002; Sellar, 2017). While the influence of these structures is recognisable in the actual and empirical, there are also deep, hidden mechanisms in the real that may be activated. Here lies an initial question, where school improvement and accountability processes move beyond the collective level, and change is required at the level of the individual agent: what mechanisms and conditions are likely to influence these changes?

Secondly, governance of schools has been traditionally seen as a relationship where external bodies have sought control over internal operations (O'Day, 2002). The nexus of this relationship tended to be built around data interaction and exchange. However, until recently, the flows of information have largely been regulated internally. Schools have controlled the data that they have collected, and while some of it has moved beyond the internal, much has been used within the walls of schools for processes of improvement. With new forms of data required by external bodies and new ways of collecting and aggregating this data, the information flow has shifted and changed. Data collected from schools is shared instantly across dashboards that are available to the external governing bodies. More knowledge and information is now thought to be known about the internal operations of a school by these external governance bodies than ever before. How does this 'knowability' change how agents act and interact at the different levels? Of critical interest is how teachers (and principals) respond to these new ways of knowing schools. Here the critical realist toolkit provides some means to explore these questions.

A critical realist conceptualisation allows for each teacher to have particular relationships that are part of the domain of the real. These unique (to the individual teacher) relationships (see Figure 3.3) may be with the nature of data and data use, accountability processes, school improvement processes, technology, peers, administration team, ideology, and students (as a starting point). Therefore, comprehending how these new ways of knowing changes outcomes rely

on understanding how teachers are relating in the domain of the real. It is assumed that many of these relationships will be activated as part of general school and work-life and the results will be recognisable in the actual and empirical. Of interest here is how and why, and in what circumstances these mechanisms are activated and to what result. Understanding how individual teachers and principals are likely to respond provides insights into the motivations and the possible outcomes of new modes of accountability in schools.

Domain of the real
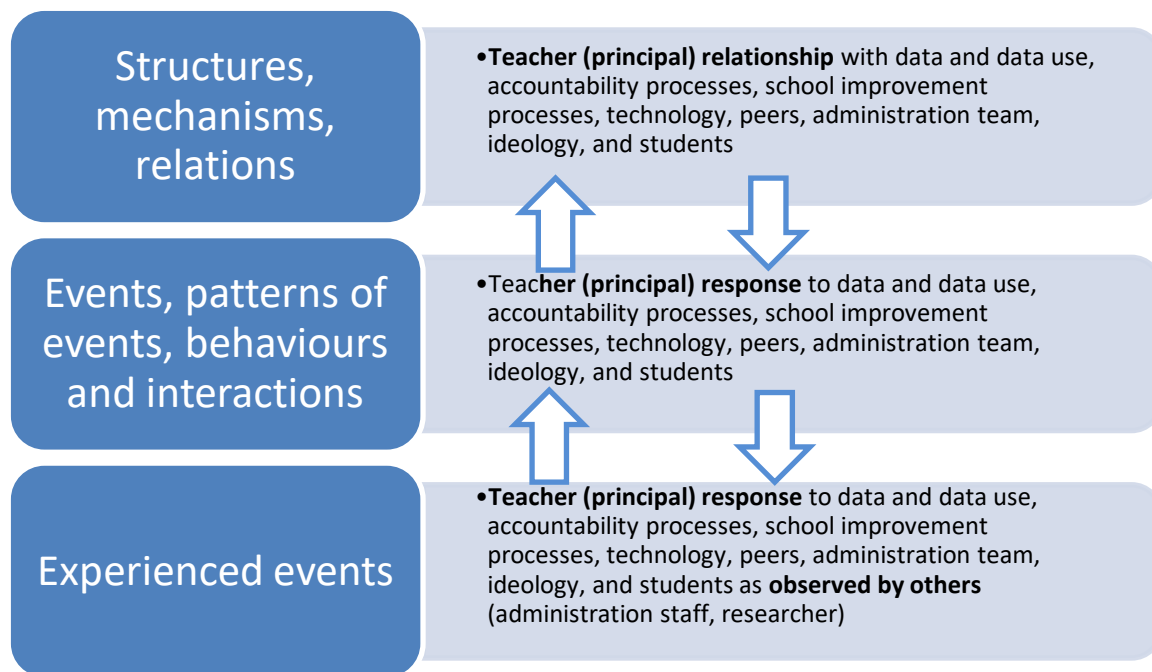
Figure 3.3: Teacher relationships across the domain of the real (adapted from Gable, 2011)

Consequently, Stage 1 of this explanatory process has drawn on general critical realist meta-theory to describe the research landscape in a way that determined a preliminary entry point into the research. Conceptualising how teachers and schools are responding to datafication, new ways of knowing of a classroom relies on building knowledge of the deep relationships that teachers hold in the domain of the real. Part of this description is locating the individual agent within and across a number of multiple levels and systems. While this has provided initial insight into the research problem, further work is required to articulate the elements that will serve as parameters for the research design. Stage two provides further tools to serve this purpose.

3.7   **Stage 2: Analytical Resolution**

The second stage of the explanatory process involves the explication of structure and context and the distinguishing of different components or dimensions. In this phase, the objective is

to separate and distinguish the various components of the study in order to identify a particular feature or features for study (Danermark et al., 2002). Each of these components or dimensions is the empirical indication of different cooperative and constraining mechanisms; for example, school improvement policy, accountability measures and datafication may interact in a specific context (a school or agent) instituting one or several hidden structures (Danermark et al., 2002). The task of the second stage, therefore, is to establish and then identify which components to include and which to leave out. Here the depth ontology of critical realism is utilised to make these analytical decisions, and in doing so begins the task of understanding the different causal properties in action in this particular social world (Case, 2013).

The previous section provided a redescription of the research problem as the deep relations that teachers have with each other and with data within complex multi-layered contexts. A critical realist view of these contexts holds clues to how and what might be shaping and conditioning this social world. A central tenet of this is to consider that the differentiation and stratification of the social world allow for the separation of the 'parts' and the 'people'(Archer, 1995). Moreover, in doing so, it focuses on the necessity of distinguishing between human action and social structure in a way that recognises the different properties of each (Bhaskar, 1989b). This understanding is an essential precondition to this research; however, in order to progress further, the distinctive ways that structure, culture and agency are positioned as key social mechanisms is considered. The next section conceptualises the interplay between structure and agency while recognising them as separate research entities. It also signals the importance of culture to this research project.

3.8   Structure and Agency (and Culture)

The 'structure-agency debate' is considered fundamental to much of practical social theorising (Archer, 1995). Subsequently, critical realists have attempted a viable solution to the argument by developing a particular understanding of the structure/agency divide (Scott, 2013) that offers alternatives for the researcher. Other methodologies investigating policy structures and teacher action have explored how schools respond to new data uses from at least two research perspectives. Firstly, schools are seen to operate within their sphere of influence with limited interaction with outside structures. This ground-up view positions the teachers as the unit of action and the source of change within the school environment. This atomised view of the actor (teacher) suggests unconstrained choices for the individual.

The second perspective considers teachers' actions are determined by the different interventions they encounter. This understanding assumes that external forces play a decisive role in what happens within a school context and that the actor (teacher) has limited choice, subsequently

acting only to reproduce the social structure (Coburn, 2016). These accounts of human agency are polar extremes, and the reality is neither so clear-cut nor unambiguous. A critical realist response to this uncertainty is to consider that both the teachers' responses to data and the external interventions in place need to be considered separately and yet together, and it is the interplay between these social structures and human action in context that is likely to provide insight into the research phenomena.

In accepting that the social world comprises structure and agency, a critical realist view provides a specific understanding of what is indicated in these circumstances. Carter and New (2004a) posit that "People as agents and actors are influenced, though not determined, by their structural situations. People choose what they do, but they make their choices from a structurally and culturally generated range of options - which they do not choose." (p. 3)

Accordingly, there are alternative ways relations between structure and agency may be interpreted when considering the nature of educational change. Structure is seen here as "a set of internally related objects, and a certain structure may in its turn be part of a greater structure" (Danermark et al., 2002, p. 178). Agency, in turn, highlights the particular property of a person that allows them to set up goals and reach them. A more nuanced definition which draws in a temporal dimension is:

> …the temporally constructed engagement by actors of different structural environments—the temporal relational contexts of action—which, through the interplay of habit, imagination, and judgment, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situations.

> (Emirbayer & Mische, 1998, p. 970)

The key question here is to ascertain how social structures and agents interact and what the relations between them are. Different paradigms within social science provide alternative theories to respond to this question. Following is a primarily critical realist understanding drawn from Archer (1995) and Bhaskar (1993) that considers the social structure and agency debate through four relational modes: downward conflation, upward conflation, structuration (Giddens, 1984) and the morphogenetic approach.

The first reifies structural conditions over agency acting in a downward direction, consequently under-theorising agents' role in societal movement. Accordingly, a research approach that favours this considers that social structure alone organises social interaction, and all influence

moves from structures to agents (Danermark et al., 2002). Here social structures are real in the sense that they can make things happen, and agents are seen as subject to these organisational and socialisation processes. Archer (1995) describes this as 'downward' conflation.

The second paradigm, acting in reverse, has social interaction and agency transforming structures. This approach situates all power with the agent, consequently reducing the potential of different structures to shape and transform the social environment. A research approach that favours this understanding sees the individual as the starting point where influence moves from agents to structures. Here Archer (1995) describes this corresponding conflation as 'upward', where structures only result from the actions of agents (Danermark et al., 2002).

The third relational mode described by Giddens (1984) as a structuration approach conflates structure and agent in a duality process where "Structures do not exist separately from individuals; they are always the medium as well as the outcome of social action" (Danermark et al., 2002, p. 179). While this mutual constitution of structure and agency has some merit, Archer (1995) argues that by defining structure and agency in terms of one another, and in temporal conjunction (time is key here), the researcher is unable to analytically separate the two. The consequence of this is a central conflation approach (a duality of structure) which is in direct opposition to what Archer describes as analytical dualism.

The fourth approach recognises the ontic differentiation between social structures and agents. A key understanding is that agency and structure are not two elements of the same process; instead, the researcher is dealing with two separate phenomena (Danermark et al., 2002). Once this essential precondition is in place, there is potential to move forward. Danermark et al. (2002) provide relatively simple access to this understanding. Social structures are always present for the agent; people are born into a social structure. Yet social structures do not exist without human intervention; they are a consequence of human action. Correspondingly, as society is a product of previous human interaction, it exists and can, therefore, be transformed and/or reproduced. Furthermore, while social structures can never be reduced to human action, they also have the potential to enable or constrain human action.

This non-conflationary position has specific advantages for the critical realist researcher and provides the foundation for Bhaskar's Transformational Model of Social Action[7] (TMSA). In this early model there exists the clear separation of structure and agency and the recognition of the different powers and properties of each. A clear separation of structure and agency and the recognition of the different powers and properties of each exists in this model. This non-conflationary position has specific advantages for the critical realist researcher and provides the foundation for Bhaskar's transformational model.

Furthermore, "the activity-, concept-, time-space and social-relation dependence of social structures" are considered to be directly drawn from the TMSA (Bhaskar, 2009 p.131). Here Bhaskar (1989a) outlines the specificity of social science, the ontological limits of naturalism as he discusses the ontological, epistemological, relational and critical differences between the natural and social sciences. These differences are:

1. Activity-dependence – social structures are dependent on human activity in a way which natural structures are not.
2. Concept-dependence – social structures cannot operate independently of some conceptualisation by agents; they are concept- or belief-dependent.
3. Space-time dependence – social structures are more space- and time-dependent in general than natural structures.
4. Internal relationality – as a social scientist, one's beliefs about the subject matter may themselves be part of the subject matter (pp. 78-79).

Key to this understanding is recognising that as Bhaskar et al. (2017, p. 62) has it, society is sui generis (uniquely) real.

This theorising of social structure has significant methodological implications for the educational researcher, which will be explored further in Chapter 4. It is worth noting here that educational systems and the schools that exist within them as social structures rely on the teachers and principals (agents) to carry out the action and social interaction that take place within the context of the social structure. At the same time, this "social interaction constitutes the school environment in which the structures are reproduced and/or transformed" (Danermark et al., 2002,

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[7] The TMSA was formulated by Bhaskar (1989a) while he was writing *The Possibility of Naturalism* and it articulates the relationship between social structure and agency while highlighting their separateness and as well as introducing the possibility of the analytical distinction between these features which Archer later expands and articulates as "analytical dualism" (Archer, 1995).

p.181). The significance of social interaction between social structure and human agency is central to this understanding. It is also what emerges from this social interaction that becomes vital here.

A further understanding recognises that social structures are rarely static and are constantly evolving, and consequently may only be effective for limited amounts of time and only in certain contexts. This conceptualisation of social structures is pertinent in education where the continuous shift in educational structures is readily acknowledged by teachers and the community in general. Consequently, any new educational practices emanating from social structures may produce limited or different outcomes in agents across these school contexts.

In separating agency from structure, a critical realist understanding distinguishes teachers from the school structure and positions them as objects of knowledge in their own right. This recognises that teachers are capable of resisting, in the same way as they can accept, the exercise of socio-cultural powers. Bhaskar comments that "Human action is characterized by the striking phenomenon of intentionality" (1989b, p. 79). Moreover, it is this reflexivity of humans that distinguishes between "the genesis of human action, lying in the reasons, intentions and plans of human beings, on the one hand; and the structures governing the reproduction and transformation of social activities, on the other" (Bhaskar, 1989b, p. 79). The distinctive difference is that "*people* cause things to happen—by doing things—and "*structures* cause things to happen— by motivating or discouraging, constraining or enabling certain sorts of human action" (Carter & New, 2004b, pp. 11-12). This understanding supposes that teachers as agents have the option to make choices concerning the use of data within the classroom. It acknowledges that agents can monitor and modify their behaviour according to their reflexivity, exemplifying the idea that 'reasons can be causes'. As such, the exercise of socio-cultural powers is dependent upon how they are received and perceived by people, and consequently, their effect is never direct, only mediated (Archer, 1995). However, while any data decision-making by the teacher may be dependent upon their conscious reasoning and understanding (agential powers), they may also be unconsciously constrained by the structural properties acting upon them (Thursfield & Hamblett, 2004).

This conceptualisation of the interplay between social structures and agents provides explanatory power in the search to understand the deep relations that teachers have, with each other and with data within complex multi-layered contexts. However, in consolidating all perceived mechanisms, i.e., accountability, school improvement and data interventions into one space and calling them social structures, another problem emerges. What of school culture—can it be considered a social structure in its own right? What understanding can be gained from the heterogeneity of the reductionist explanation of culture as 'the way we do things around here'

(Willmott, 2002)? Given the complex questions entailed, a construct of culture that provides sufficient explanatory purchase is a difficult proposition. There is a lack of granularity around some conceptions of culture that ignore the various components of culture, such as beliefs, theories, arguments and values. Accordingly, these ideational elements are often overlooked or simply conflated into structures with little acknowledgement of the irreducible properties and powers they hold and that serve to condition agents to sometimes respond in certain ways. In defining culture, Hays (1994) provides a starting point:

> Culture must be understood as a social structure if the term is to be consistently applied. Culture is a social, durable, layered pattern of cognitive and normative systems that are at once material and ideal, objective and subjective, embodied in artefacts and embedded in behaviour, passed about in interaction, internalized in personalities, and externalized in institutions…Culture is both the product of human interaction and the producer of certain forms of human interaction. Culture is both constraining and enabling. Culture is a social structure with an underlying logic of its own.

> (p. 65)

However, while Hay accepts culture as an analytically separable element, she places culture as a subordinate to social structure, arguing that it (social structure) is made of "*two* central interconnected elements: systems of social relations and systems of meanings" (p. 65). This is contrary to Archer (1996) who positions culture as a separate system with its own powers, autonomy and relative endurability. Here, culture is imagined from a Popperian World 3 perspective:

> By World 3, I mean the world of the products of the human mind, such as languages; tales and stories and religious myths; scientific conjectures or theories, and mathematical constructions; songs and symphonies; paintings and sculptures. But also, aeroplanes and airports and other feats of engineering. It would be easy to distinguish a number of different worlds within what I call World 3. We could distinguish the world of science from the world of fiction, and the world of music and the world of art from the world of engineering. For simplicity's sake I shall speak about one World 3; that is, the world of the products of the human mind.

> (Popper, 1979, p. 144)

Archer describes this construct of culture as a world of ideas that can be comprehended by the human mind, as well as a cultural system, one that holds propositions that in turn can be challenged or contradicted (Archer, 1996). What this means is that at the level of the real, where causal mechanisms are positioned, the focus is largely on the relationship between ideas; however, at the level of the actual it is more relevant to consider who has the ideas and who else can be persuaded to adopt these ideas (Case, 2013). This is the world of socio-cultural interaction.

Making the distinction between the Cultural System and Socio-Cultural interaction affords the researcher the opportunity to theorise about the conditions for cultural stability or change by examining the interplay between the two (Archer, 1996). It also affords the opportunity to conceptualise the cultural system as having different sets of properties that operate on different levels, some at a theoretical and others from a doctrinal/belief/ideational or policy/principle level. The critical realist consequence of this is that there are two ways to think about these properties; one that lies in the intransitive, where the phenomenon exists independently of any knowledge we have of it, and the other, the transitive, which contains our (often fallible) understandings of the phenomenon.

Accordingly, when analysing the cultural conditioning that may influence teacher data use, there might be a set of ideas on what might constitute legitimate data for teachers to use. There might also be a set of ideas in play about how best to use data in schools. These ideas exist in the transitive realm, and subsequently, they are subject to question and change. We can see here that powerful sets of cultural ideas may hold authority in education, and while causal consensus might exist, there is always the potential for agents to challenge these ideas.

This returns to the proposition made earlier of the potential for critical realism to unravel the complexity of the new ways of knowing schools through data and the effects this understanding has on teachers. The issue here then is deciding at which level of social reality this analysis will attend to and the reason this focus is taken. Arguably, teachers have always relied on forms of practical knowledge or 'know-how' about their students, which has informed their teaching. However, this intuitive teaching is also "ideationally grounded"; it is underpinned by philosophical assumptions that may go unrecognised by the teacher (Willmott, 2002, p. 47). This contrasts with the structurally conditioned use of ideas about data in schools that reinforces the implementation of standardised testing and the National Curriculum. The ideational nature of these policy implementations has logical consequences for practices of which teachers as agents may or may not be aware. These implications may be explicitly acknowledged; however, there is always the possibility that other agents (government, education offices or principals) may choose to obscure this understanding for

strategic reasons of their own (Willmott, 2002). Foregrounded here is the reliance on the proposition that it is the use of ideas that conditions teacher activity (Willmott, 2002). It is these possible structural -ideational contradictions that form the basis for this research project. In Chapter 5, 6 and 7, the extent of the structural and cultural constraints imposed on teachers by new ways of data use will be further examined.

In summary, this second stage of analytic resolution has provided further insight into the research problem by identifying some of the causal components likely to be influential in teacher responses to new data uses:

1. The prospective influence of the structure-agential interplay from the material perspective of the teacher and the teacher awareness of the relational implications.
2. The prospective influence of the cultural-agential interplay from the ideational perspective of the teacher and the teacher awareness of the relational implications.

These components provide further direction for the research project, focussing as they do on the issues identified in the literature review of complex accountability relationships, data processes and datafication, school transformation and data routines/sensemaking that underpin how teachers are responding to the increased data use in schools. Reconceptualising structure, culture and agency in a non-conflationary way provides a pathway to analytical dualism, where it is recognised that the respective elements each possess distinctive powers and properties. This separation is an analytic decision which supports research into the way structure and culture are mediated by the intentions of human agents; however, because they are emergent, they cannot be reduced to single human activities (Case, 2013).

Bringing attention to these components provides some clarity to the research problem and has reduced the scope of the study to the interplay of structural and cultural relations with human agency. It also recognises the broader social powers within the research space. While Stage 2 has identified the likely objects of knowledge in the study, attention is now turned to the possible frameworks or methodology that will serve here as a necessary link between social ontology and practical theory (Archer, 1995). The next section is an opportunity to interpret, and then redescribe how these conceptual theories about structures and relations provide further insight into the research space and propose some preliminary research questions.

3.9 **Stage 3: Abduction/Theoretical Redescription**

The objective in Stage 3 is to interpret and redescribe the different components from the conceptual frameworks developed in Stage 2 and consider these objects of study through different

lenses or ideas (Danermark et al., 2002). In this case, this theoretical redescription guides in order to describe "not only what social reality is, but also how to begin to explain it (Archer, 1995, p. 5). By considering the activity, concept and space-time dependence that ontologically differentiates social from natural structures, the opportunity presents itself to ask "What must be the case (in terms of beliefs or conceptualizations) for a particular institution or aspect of society to be possible" (Bhaskar et al., 2017, p. 63).

The critical realist toolkit has so far provided a series of steps to identify possible objects of knowledge and to further refine the research project. However, there is still a substantial gap between this critical realist underlabouring and an accessible methodological approach. Bhaskar's early work argues that it is analytically possible to separate structure and agency; however, it is Archer's (1995) morphogenetic approach (M/M) that supports the means to identify and unpack the complexities of educational change by examining the interplay between structure, culture and agency over time. Accordingly, this next section outlines the central claims of the morphogenetic (and morphostatic) approach and justifies its adoption here as a high-level methodological discourse.

3.10 The Morphogenetic Approach

A fundamental premise of the morphogenetic approach recognises that schools are part of complex, open social systems that as human constitutions, cannot be modelled on any other system. Archer argues that the special nature of these systems, therefore, requires an understanding that acknowledges this openness, its 'peopled' nature and potential for change. Embracing Buckley's (1967) definition of morphogenesis, Archer notes:

> …the use of the term 'morphogenesis' to describe the process of social structuring; 'morpho' indicating shape, and 'genesis' signalling that the shaping is the product of social relations. Thus 'Morphogenesis' refers to 'those processes which tend to elaborate or change a system's given form, state or structure'. Conversely, 'morphostasis' refers to those processes in complex system environmental exchanges which tend to preserve or maintain a system's given form, organisation or state.

> (Buckley (1967) in Archer, 1995, p. 166)

Originating from general systems theory, Buckley (1967) saw morphogenesis as a response to "an over-emphasis on the internal system at the expense of situational and environmental factors" (Willmott, 2002, p.30). Lockwood's (1964) seminal article "Social integration and system integration" further laid the foundations for the morphogenetic approach as a framework for giving

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an account of the existence of particular structures at particular times and in particular places (Archer, 2011). His unique (at the time) approach made the distinction between 'system' and 'social' integration, paving the way for Archer to theorise about the interplay between structure and agency and the possibility of differing causal powers (Archer, 1995, 2011).

What sets Archer's understanding apart is the recognition that the analysis of the interplay between social structure (culture) and human agency requires an approach that includes theorising about the temporal relations between these components. Accordingly, this structuring over time allows the realist notion of emergence as a process and that what emerges at each new stratum or level has its own properties and powers. These emergent properties are not reducible to the previous levels. Recognising the possibility of emergence frees the researcher to consider the world in contextual strata, each with its own set of emergent properties and outcomes that are irreducible to the former and consequently analytically separable. This analytical dualism is a core precept of Archer's (1995) realist social methodology supporting as it does, the possibility of structural and cultural emergent properties, their subsequent identification, and the part they play in shaping agency.

Schools, as social structures, are embedded in a series of complex layers; yet, each school is also a set of structural and cultural arrangements that also have the potential to enable or constrain the actions of teachers within. Accordingly, teachers going to school each day enter a world that has been structurally and culturally influenced by a previous set of social interactions. It is a space not of their making; yet, they have the potential agency to mediate the conditions in which they find themselves. The extent of this teacher agency will be explored further—it is, in fact, the heart of this research—however before any of this happens Archer (1995) contends the parts must be separated from the people.

Accordingly, analytical dualism makes possible the analysis of the interplay between structure and agency through the reasoning that firstly, structure and agency can be considered different kinds of emergent entities (Bhaskar, 1989b), despite the understanding that they are vital for "each other's formation, continuation and development" (Archer, 2016, p. 4). Moreover, that this explanatory methodology relies on structure and agency operating "over different time periods because (i) structure necessarily predates the action(s) that transform it, and (ii) structural elaboration necessarily post-dates those actions" (Archer, 2016, p. 4). This is the basic morphogenetic approach (see Figures 3.4 and 3.5).
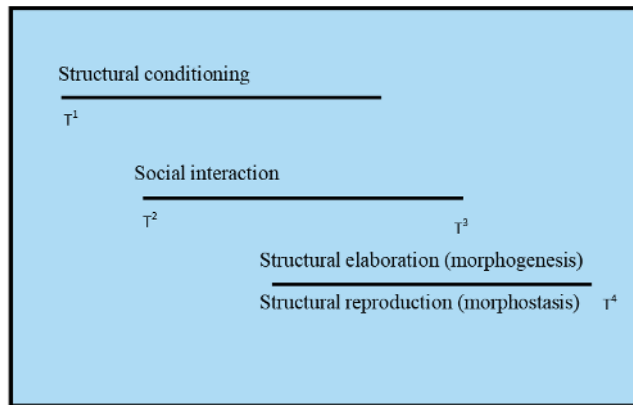
Figure 3.4: The three phases of the basic morphogenetic/static cycle for structure (Archer, 1995, p. 157)
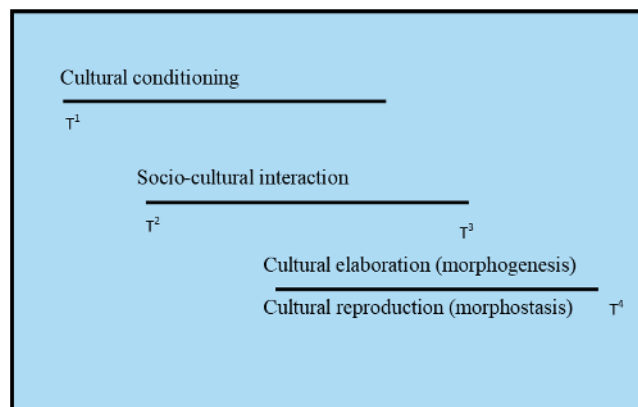
Figure 3.5: The three phases of the basic morphogenetic/static cycle for culture (Archer, 1995, p. 157)

Archer's (1995, 1996) methodological reasoning suggests that as structure, culture and agency are continually at work in society, what is required is an opportunity to break up this flow and analytically separate these processes into three distinct stages termed Emergence–Interplay–Outcome (p. 168). This allows the practical application of the morphogenetic approach through the presence of four propositions:

i.   There are internal and necessary relations within and between social structures.

ii.   Causal influences are exerted by social structures on social interaction.

iii.   There are causal relationships between groups and individuals at the level of social interaction.

iv.   Social interaction elaborates upon the composition(s) of social structures(s) by modifying current internal and necessary structural relationships and introducing new ones where morphogenesis is concerned. Alternatively, social interaction

reproduces existing internal and necessary structural relations where morphostasis applies.

<div align="right">(Archer, 1995, pp. 168-169)</div>

Accordingly, the morphogenetic approach can be visualised as an endless series of three-part cycles, which works well when examining a sequence of phases (Willmott, 2002). In this, the morphogenetic approach favours a "form of narrative history" in order to develop a model explanation" (Porpora, 2013, p. 29). Archer favours "analytical histories of emergence" as the most precise way of describing the practical outcomes of the morphogenetic approach (1995, p. 197). Either way, the morphogenetic approach merges the sense of the 'here and now' and the historicity that is required of a 'before, during and after' analysis of educational change (Willmott, 2002).

The implication of the morphogenetic model for this study, therefore, lies in its potential to say something meaningful about teacher response to the cycle of school reform processes driving the intensified data use in schools. Teachers as agents have the potential to mediate the structural and cultural conditions they find themselves in. However, these arrangements are not of their making, and while they can respond to them, these material and ideational influences may be incompatible with their understanding and belief systems. Consequently, the first stage of the morphogenetic cycle is where our teachers as agents involuntarily confront a situation which has been "objectively shaped by both structural and cultural properties" (Case, 2013, p. 47). Their response to these situations is conditioned, not determined, in a mediation process that can be clearly described through several aspects that include: involuntaristic placement, vested interests, opportunity costs, degrees of interpretative freedom and directional guidance (Archer, 1995). This Archerian view of the social world imbues these aspects with properties that explain how and why agents respond to these emergent contexts.

What is happening in the teachers' present is a result of past interactions. How they respond is also determined by the prior distribution of resources and positions. Pre-structured positions (principal-teacher, principal-assistant regional director) supply agents with reasons to pursue change or hold fast to the current arrangements because of *vested interests* inherent to them (Archer, 1995). However, teachers are still more likely to be motivated by an interest that affords a good outcome (for someone), and within this decision-making process, they require inducements in the form of *opportunity costs* which may come with the development or protection of their vested interests.

In this way, real structural and cultural influences mean that impartial opportunity costs are associated with different agents' responses to challenging and rewarding situations which specify

the way agents' interpret these situations (Archer, 1995). Even while it appears agents are powerless in the face of such social power, the process of mediation holds the understanding that agents retain the capacity for reflexive thought and behaviour. Teachers, as agents, have *degrees of interpretative freedom* that recognise that reasons for doing something must be considered and balanced against costs and the benefits associated with whatever action is taken. Archer (1995) maintains that "Action, then, has been consistently seen as resulting from the confluence of the powers of the 'parts' and the 'people'"(p. 209).

Accordingly, how (and why) new data routines affect change in the way teachers relate to each depends on the opportunities and courses of action available to them. In this, the possibility of change in practice relies on teachers making choices based on what their options might be. Understanding what these options are and how this subsequent conditioning shapes teachers' practical situations is determined by finding the bridge between "real but unobservable systemic properties, and their impact on daily experience at the level of events" (Archer, 1995, p. 215). Coburn and Turner (2011b) maintain that "(t)he theory of action underlying many data use interventions is simply that teachers and principals will examine data and adjust their practices to support student learning" (p. 193). How these mediating mechanisms shape agential response requires a more specific approach, one which distinguishes "how quite distinctive *situational logics* which predispose agents towards *specific courses of action* for the promotion of their interests, is created by the relations within and between the various structural and cultural emergent properties" (Archer, 1995, p. 216).

What the morphogenetic approach does from here is uncover the situational logics of structural (and cultural) configurations, mechanisms that are likely to be causally influential in the complex social arrangements of a school. In connecting structural (and cultural) arrangements with agential action in an analytical sequence, it supports the understanding of conditioning, not determinism, shaping situations by providing strategic guidance (good reasons) for particular courses of action (Archer, 1995). In other words, while teachers as agents have choices, these choices are always enabled or constrained by prior structural arrangements.

Accordingly, which particular courses of action teachers follow in response to the complex social relations emergent from structural and cultural arrangements of data are dependent on the resources allocated to them and the rewards or penalties associated with following or ignoring strategic guidance (Archer, 1995). To effect educational change then relies on the decisions that agents make and the degree to which they are supported/resourced or constrained by the school (or external agents) to accomplish this change.

However, these choices are not made alone, and so it is at the level of interaction that independent causal relationships between groups and individuals can be revealed (Case, 2013). The outcome of these interactions can be further elaboration or reproduction of structural and/or cultural arrangements (See Figure 3.7). Highlighting the potential intersection between structure and culture recognises that changes in the realm of culture can impact on the realm of structure and vice versa. Additionally, that agency also generates its effects in this cycle of change and reproduction. Because structure and culture are largely autonomous, their respective emergent properties are often asynchronous leading to the possibility of either structure or culture being morphogenetic, while the other remains morphostatic (Archer, 1995, 1996). This incongruity has several implications for analysis in future stages of the research project. For now, recognising that culture may act as a drag on structure and the reverse is enough.

3.11 **Agential Elaboration**

The previous section focused on the role social agents and their interaction play in the transformation or reproduction of structure and culture. This change relies on the results of these interactions to determine change at the structural and cultural level and the forwarding of these new structures to the next generation of people (Archer, 1995). However, Archer's conceptual framing also includes the understanding that while agency is transforming (reproducing) structure and culture, it too is being changed in what Archer (1995) refers to as the double morphogenesis. This conceptualisation of agency acknowledges that transformation takes place when agents attempt to promote or protect their vested interests and in doing so, they undergo a form of re-grouping themselves (see Figure 3.6).

In the case of our teachers, this occurs when they consciously recognise the changes in school governance affecting their daily work. How these new processes and practices, underpinned by data, impact teachers' working lives and how they are enabled or constrained can be theorised using Archer's stratified understanding of agency. Accordingly, groups can move from primary to corporate status as their initial bargaining power is enhanced, however, how successful this is and what happens next is the issue for this empirical investigation.

The methodological value of the morphogenetic approach becomes apparent when we move to practical theorising of how teachers are responding to data use processes and new ways of knowing schools. In linking structural and cultural arrangements with agential concerns, Archer furnishes a framework for understanding social change and reproduction in complex open systems. This structural/cultural/agential interplay takes place in changing contextual circumstances where teachers at any one time are positioned as agents of change, barriers to change or agents subject to

change dependent on the setting. This conflicted understanding first identified in the literature review draws attention to how teachers negotiate these often-contradictory conditions.
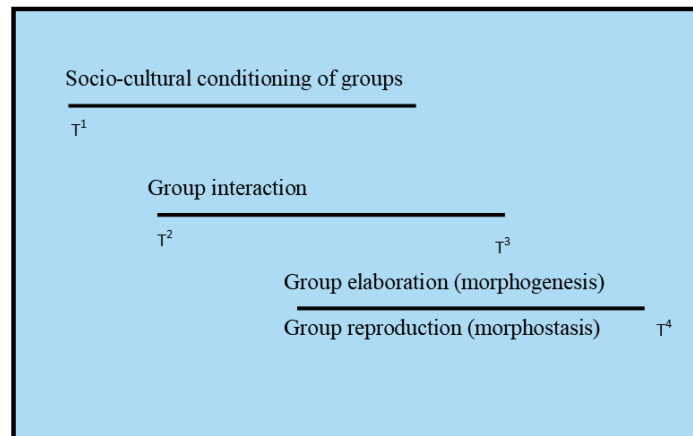
Figure 3.6:The three phases of the basic morphogenetic/static cycle for agency (Archer, 1995, p. 194)

The morphogenetic approach supplies the conceptual framing through analytical dualism and emergence to separate and evaluate the relative contributions of structure, culture and agency in instances of social change. This is apparent when we examine some of the issues emphasised in the current literature concerning the nature of accountability relationships emergent from the implementation of practices of data use at the school level. The morphogenetic approach may uncover how the ideational (or ideological) foundations of accountability (cultural arrangements) that enable power to persist as an emergent property of certain roles and systems in schools (social structures) is likely to enable and/or constrain teacher agency (Priestley, Biesta, & Robinson, 2012). Conversely, the approach is also capable of revealing how teachers can alter, circumvent or ignore exercises of power and so exercise their own agency. Figure 3.7 illustrates how the morphogenetic approach supports an analysis of school reform. As a methodological tool, it provides the researcher with a framework for examining the socio-cultural interaction that occurs at the centre of the system, by relating how knowledge and practice are shaped in complex social environments like schools (Priestley, 2011). This "zone of social interaction" is the engine-room of change (or reproduction) and remains the crucial core focus of a social realist analysis (Wallace and Priestley, 2011 p.362).
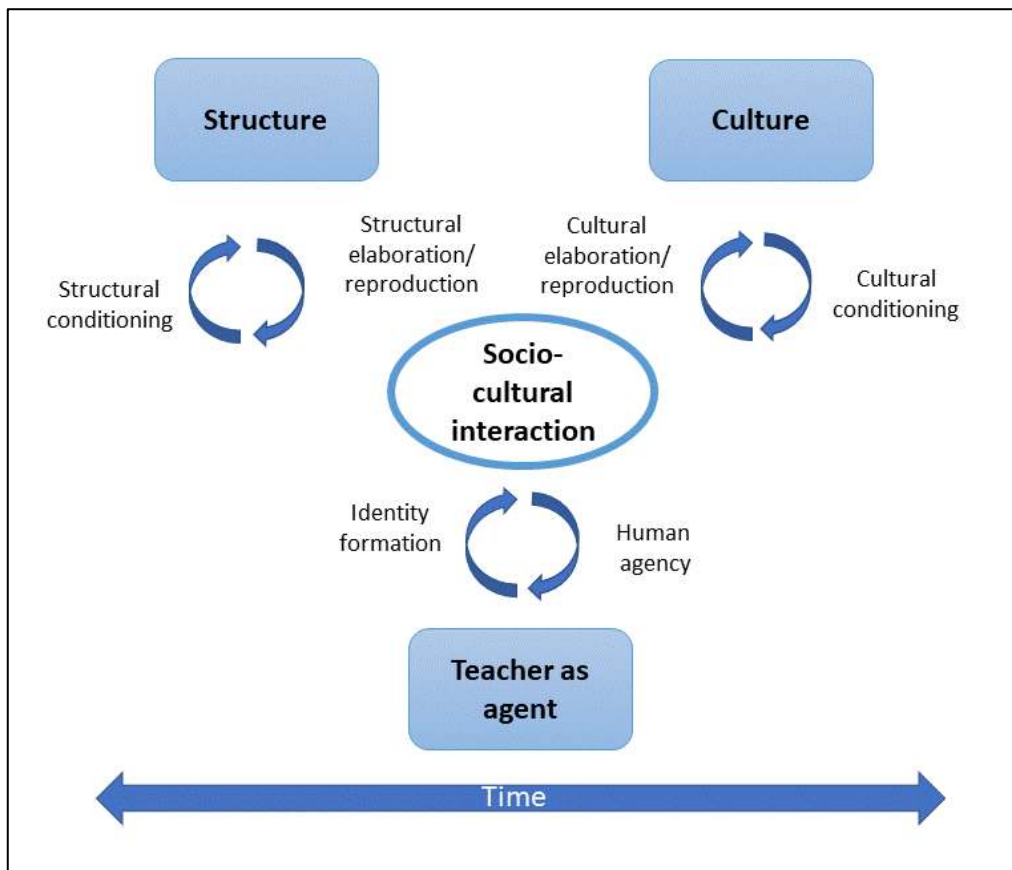
Figure 3.7: The morphogenetic approach (adapted from Priestley, 2011a, p. 229)

Considering the research problem through the lens of structure, culture and agency reconceptualise issues of accountability, school improvement and data use in schools as one of the relationships which guide sense- and then choice-making. Additionally, it refocuses the attention on the mechanisms and powers that are likely to influence these relationships within and external to the school structure. It is now possible to consider some propositional research questions:

1. What pre-existing structural and cultural conditions influence the way data is used in Queensland primary schools?
2. What are the key dimensions of data use in Queensland primary schools?
3. How does engagement with data inform professional practice and teacher learning in school contexts?
4. How might data use constrain or enable principal-teacher agency within the Queensland state primary school environment?

3.12 **In Summary**

This chapter has described a research problem that seeks an understanding of the complex conditioning shaping teachers' responses to new data use in schools. The phenomenon is characterised by uneasy knowledge bases, complex open systems and numerous structural arrangements likely to affect educational settings. A review of the literature in Chapter 2 revealed several contradictory aspects that characterised the research phenomenon. These centred on the complex relationships that have emerged from a dual emphasis on the implementation of school improvement initiatives and current accountability regimes, further complicated by new ways of knowing schools through data.

Although marked by some inconsistencies, each of these perspectives furnishes another facet to the complex framework that is central to how data use evolves in schools. The knowledge bases revealed: complex, multiple-layered data routines and interactions, data-informed accountability and school improvement measures, more intensified data relationships, and policy and governance interventions driving school reform. A preliminary evaluation of these interactions revealed a tangled mess unlikely to provide clear direction for the researcher. Accordingly, while these knowledge bases were potentially aligned around data use in schools, there remained a fundamental lack of clarity as to how they might be redrawn into a convergent framework to support empirical research into the changing nature of data use in schools.

Consequently, an approach that aligns uneasy research bases, that recognises the complexities of researching in open systems and that focuses on exposing the structures that influence agents in educational settings was most closely aligned with the ontological nature of the object of knowledge being investigated, namely, the ideas inside teachers' heads about the datafication of education. Critical realism provides a functional theoretical base which has the potential to support the researcher in these endeavours. There are several functions of the promised theoretical 'underlabouring' of critical realism: improvement of the researcher's capacity for reflexivity, the resolution of the structure-agency problem, and critical realism's social agenda of emancipation. However, the real value of the process is to provide some guidelines with which to explore complex research phenomena.

In Chapter 3, Stages 1, 2 and 3 of a six-stage explanatory model of social science were applied to refine the objects of this study, find an entry point into the research and determine a possible methodological approach. Using this explanatory process, Stage 1 drew on general critical realist meta-theory to re-describe the research landscape in a way that has determined possible objects of study in the research context. An initial review directed attention to how school

improvement processes and modes of accountability operating in a complex space were further complicated by datafication and new ways of knowing schools. Additional theorising revealed that determining how teachers and schools responded to datafication was reliant on knowledge of the deep relationships that teachers hold in the domain of the real. This insight focused the research attention on data-use processes and the relationships that are emergent from them.

The second stage of the explanatory process involved the explication of structure and context and subsequent distinguishing of different components or dimensions. Moreover, in doing so, it focused on the necessity of distinguishing between human action and social structure in a way that recognises the different properties of each (Bhaskar, 1989b). Consequently, Stage 2 directed researcher attention to the interplay of structural and cultural relations with human agency; these components of interest further reduced the study scope. This added clarity to the research project; however, what remained missing was a framework or methodology that would serve here as a necessary link between social ontology and practical theory (Archer, 1995).

The objective then in Stage 3 was to interpret and redescribe the different components from the conceptual frameworks developed in Stage 2 and consider these components through different lenses or ideas (Danermark et al., 2002). How agents reproduce and transform structures and recognising that, in turn, structures act back on agents, enabling and constraining actions is fundamental to critical realist understanding. However, there was still a substantial gap between this critical realist underlabouring and identifying a suitable methodological approach to apply in the research setting.

Accordingly, the morphogenetic approach supplies the conceptual framing through analytical dualism and emergence over time to separate and evaluate the relative contributions of structure, culture and agency in instances of social change. Aligning my study with Archer's social realist approach recognises the complex nature of the methodological propositions that are to be put to work in the search for explanatory purchase here. Theorising about the interplay between school improvement rhetoric, accountability regimes and how teachers might negotiate and mediate the new ways of working with data in schools through Archer's understanding of social structure, culture and agency have required some foreshadowing to ensure the rationale for this choice is clarified and supported. It also provides a substantial engagement with the ontological and epistemological assumptions informing this explanatory methodological framework for those new to the tenets of critical realism.

Consequently, this chapter explored the tenets of critical realism and the value this philosophy affords the educational researcher. It initially positions the study in the critical realist

philosophical space developed across a lifetime by Roy Bhaskar. While this understanding is foundational to the research, here it serves as a substantial building block for Margaret Archer's morphogenetic approach, a social realist theory that provides the methodological drive to the study. Specifically, Archer's temporal understanding of the cyclic interplay between structure, culture and agency delivers insight into educational processes, data use, and relations between agents across any number of contextual levels. By establishing a morphogenetic cycle, the argument is made that this depth ontology can separate the many causal mechanisms and properties that might be at work within this complex research landscape.

<center>**4. Research Design, Methodology and Methods**</center>

4.1   **Introduction**

This chapter describes the research design and approach to data collection and analysis used in this study. The first section explains in more detail how critical realism and the morphogenetic model are used to make methodological decisions in educational research. Second, the synergies between a social realist understanding of school processes and case study research are developed. Included in this section is the rationale for my case selection and an introduction to the four cases selected for the study. Third, the ethical dimensions underpinning this research design and the subsequent decision-making around data collection modes and methods are discussed. This includes details of the process of engaging research participants and the actual data collection tools and process. The fourth section makes implicit the relationship between data, evidence and theory and the subsequent analysis process utilising the morphogenetic approach and other analysis tools.

A critical realist perspective underlabours for the researcher, drawing critically on Bhaskar's understanding that there is potential within the critical realism toolbox to reduce and define objects of knowledge in complex research environments (Bhaskar, Danermark, & Price, 2017). As established in Chapter 3, CR functions as a platform from which to build a range of theories, rather than a methodological approach. Archer's (1995) morphogenetic approach offers a functional epistemological framework with which to theorise about change in complex social settings. Its role as a high-level methodological discourse, however, made the task of producing suitable explanations a challenging endeavour. Consequently, this comparative case study research design drew on a six-stage explanatory model (see Section 3.5 and 4.3) and a process of middle-range theory generation grounded in data. The subsequent qualitative comparative case study involved four case schools located in south-east rural and urban Queensland.

4.2   **Methodological Choices**

Educational research takes place in an open system; hence this study's adoption of a qualitative approach avoids the question of whether closed system experimentation (traditionally quantitative) can provide sufficient explanatory purchase for the CR researcher (Shipway, 2011). It also moves the argument beyond the positivist approach which can often prevail in education where objections to quantitative research can include among other things: "misleading descriptions of structural properties and a neglect of ontological and epistemological emergence" (Scott, 2013, p. 17). There is a very real articulated concern to utilise a methodology that supports the CR conception of the stratified nature of the world, shifting explanatory focus from the world of

experiences to the world of mechanisms and structures that might explain these experiences (Carter & New, 2004). Furthermore, CR does not dictate methodological choices; it only advises that the process be robust enough that the researcher has sufficient tools to separate the 'empirical' experience of the individual from the 'actual and the 'real' (see section 3.4). For CR-directed social science researchers, therefore, the task of a research method is essentially to connect the inward world of ideas to the external world of observable events in a way that makes sense of the phenomena and importantly the process involved (Ackroyd & Karlsson, 2014). Accordingly, the CR researcher can usually adopt a more flexible and adaptive stance to research methods compared to more rule-bound approaches.

The specification of qualitative study positions the research design as intensive where the questions concern "causal explanation of the production of certain objects or events" and their potential outcomes (Sayer, 1992, p. 243). Here in the search for how a mechanism might work in a concrete situation, the researcher studies fewer cases more intensively in order to determine, what took place, what did agents do and what might have changed (Danermark et al., 2002; Sayer, 1992). Intensive research tends to focus on causal groups which, while sharing some similarities or differences, can be directly related structurally or causally to each other (Sayer, 1992).

Furthermore, the researcher is looking for plausible explanations and theories of what mechanisms have generated the phenomenon under investigation (Danermark et al. 2002). In this case, the intensive research design is ideally situated to capture the social relations likely to emerge from new uses of data in schools. This theory development does, however, rely on methodological tools capable of making these connections and distinguishing between the actual and the real as a means to understanding the empirical experience of the research participants (Meyer & Lunnay, 2013). In critical realist research, two modes of inference, abduction and retroduction are accepted as ways of "reasoning, arguing and relating the individual to the universal/general", in what Danermark et al. (2002) identify as "thought operations" (p. 88). Following is an overview of these methodological tools.

Abduction is a process of inference that is concerned with making associations. It allows the researcher to test different frames of interpretation and to discern relations and connections not immediately apparent in the first instance (Meyer & Lunnay, 2013). Here, skilful application supports interpretation or recontextualization processes that can isolate certain aspects of the object of study, consequently becoming a means of "acquiring knowledge of how various phenomena can be part of and explained in relation to structures, internal relations and contexts which are not directly observable" (Danermark et al., 2002, p. 92). When applied in practice, abstraction is a form

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of testing which allows the researcher to develop theory by investigating findings that may not be situated within current social theories of the phenomenon, in this research, new ways of knowing in schools.

Applying retroductive logic moves the analysis on from the empirically observable to asking questions about what is fundamental to the research phenomenon (Meyer and Lunnay, 2013). While some have suggested that abstraction and retroduction can be treated as one process— a single movement from the data to the best explanatory theory (Vincent & O'Mahoney, 2018)—here, at least initially, they are separated[8]. Wynn and Williams (2012) explain the indispensable nature of retroduction as a mode of inference in CR metatheory:

> The principle of retroduction, the core of the CR explanatory model, is derived from the ontological assumption of emergence and epistemological focus on explanation, the use of causal mechanisms as the basis for this explanation, the potential for multiple potential explanations, and the knowledge that these causal mechanisms may or may not be observable empirically. Philosophically, retroduction is a form of inference that seeks to meet the CR goal of explaining by identifying and verifying the existence of a set of mechanisms which are theorized to have generated the phenomena under study.

> (pp. 799-800)

While there is clear evidence of the importance of a retroductive methodology in the CR toolbox, there is only some guidance as to how to apply the process within a research framework. Recognising the imaginative nature of the process and the retroductive argument that asks "what would, if it were real, bring about, produce, cause or explain a phenomenon" (Bhaskar, 2016, p. 22) situates retroduction as a creative and iterative business that can take place at any point in the research process from development of a study's conceptual framework (Gable, 2011), during data collection and analysis (Wynn & Williams, 2012) and while developing analytic frameworks for interpreting and explaining data (Crinson, 2007).

Consequently, the process is likely to identify various potential mechanisms on different levels and interact in different ways to produce the events under scrutiny (Wynn & Williams, 2012). Here then, the researcher is obliged to revisit theory to identify the most convincing explanation; the

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[8] Bhaskar (2016) argues that the two processes often shade into each other and that there is only a relative difference between the two.

one with the most explanatory power in the specific context. This is a hypothetical model-building exercise where alternative explanatory mechanisms and structures assumed to produce empirical phenomena are drawn together for the researcher to employ or eliminate the alternatives (Bhaskar, 1979, 2016). The researcher must decide which model (of mechanisms and structures) if it existed and acted in this way would account for the phenomenon in question (Zachariadis, Scott, & Barrett, 2013). This research process is evident in Chapter 6, forming a methodological and empirical bridge between Chapter 5 and Chapter 7. Once identified, the researcher returns to her earlier findings and corrects/adjusts as a result of this new explanation or analysis (Bhaskar, 2016).

This model building is an interactive and creative process, and as Olsen (2007) acknowledges:

> It is important to recognise that as knowers, we are transitively involved in the world we are exploring. Here, knowing about (data) can't be done in a vacuum, and it does invoke the agency of the knowers. Knowing is a *praxis*…Retroduction is a way of naming the process of getting-to-know.
>
> (p. 3)

Accordingly, to frame this retroductive methodology and to facilitate a more systematic move between the concrete, the abstract and back to the concrete, an explanatory framework was implemented.

4.3   A Six-Stage Explanatory Framework

An explanatory framework for critical realism was adopted for this critical realist case study research (see Section 3.5). Danermark et al. (2002) argue the purpose of the model is to "guide research that is seeking to attain [not only] knowledge of constitutive qualities and causal mechanisms generating events, but also knowledge of how different mechanisms cooperate and, under specific circumstances contribute to the production of concrete events and processes" (p. 108). Presented as an integrative model, they argue that the process is 'more like guidelines' rather a framework that should be followed exactly. Accordingly, researchers from different disciplines have used the model to frame their studies (Dobson et al., 2013; Mingers, Mutch, & Willcocks, 2013), structure books (Wagner, 2016), refine research focus, develop research questions and analyse, consequently giving structure to the 'underlabouring' process of critical realism (Gable, 2011).

The six stages are presented in full in Table 4.1 in order to demonstrate clearly how and why the research was structured just so. While Danermark et al. (2002) describe each step as a stage from one to six, they make it clear that these are not ordinal and the researcher is free to move between stages when necessary. These different types of discovery logic informed this research process (Bhaskar et al., 2017) with some modifications.

Table 4.1: Explanatory model of social science (Danermark et al., 2002, pp. 109-111)

Stage	Description
Stage 1: Description	An explanatory social science analysis usually starts in the concrete. We describe the often complex and composite event or situation we intend to study. In this we make use of everyday concepts. An important part of this description is the interpretations of the persons involved and their way of describing the current situation. Most events should be described by qualitative as well as by quantitative methods.
Stage 2: Analytical resolution	In this phase we separate or dissolve the composite and the complex by distinguishing the various components, aspects or dimensions. The concept of scientific analysis usually alludes to just this (analysis = a separating or dissolving examination). It is never possible to study anything in all its different components. Therefore, we must in practice confine ourselves to studying certain components but not others.
Stage 3: Abduction/theoretical redescription	Here we interpret and redescribe the different components/aspects from hypothetical conceptual frameworks and theories about structure and relations. This stage thus corresponds to what has been described above as abduction and redescription. The original ideas of the objects of study are developed when we place them in new contexts of ideas. Here several different theoretical interpretations and explanations can and should be presented, compared and possibly integrated with one another.
Stage 4: Retroduction	Here the different methodological strategies described above are employed. The purpose is for each one of the different components/aspects we have decided to focus on, to try to find the answers to questions like: What is fundamentally constitutive for the structures and relations (X), highlighted in stage 3? How is X possible? What properties must exist for X to be what X is? What causal mechanisms are related to X? In the concrete research process, we have of course in many cases access to already established concepts supplying satisfactory answers to questions of this type. In research practice, stages 3 and 4 are closely related.
Stage 5: Comparison between different theories and abstractions	In this stage one elaborates and estimates the relative explanatory power of the mechanisms and structures which have been described by means of abduction and retroduction within the frame of stages 3 and 4. (This stage can also be described as part of stage 4.) In some cases, one might conclude that one theory – unlike competitive theories – describes the necessary conditions for what is to be explained, and therefore has greater explanatory power. In other cases, the theories are rather complementary, as they focus on partly different but nevertheless necessary conditions.
Stage 6: Concretization and contextualization	Concretization involves examining how different structures and mechanisms manifest themselves in concrete situations. Here one stresses the importance of studying the manner in which mechanisms interact with other mechanisms at different levels, under specific conditions. The aim of these studies is twofold: first, to interpret the meanings of these mechanisms as they come into view in a certain context; second, to contribute to explanations of concrete events and processes. In these explanations it is essential to distinguish between the more structural conditions and the accidental circumstances. This stage of the research process is of particular importance in applied science.

The explanatory model is implemented here following Gable's (2011) modification of the stages. Rather than only supporting the interpretation of data, it scaffolds the initial scoping process, (Dobson et al., 2013) and the development of the conceptual framework, and the subsequent data analysis. In this respect, the explanatory model supported the research as a procedural model, one that guided and shaped the research at certain points where the inherent complexities of the phenomenon became apparent (Dobson et al., 2013).

Gable (2011) argues that the model, informed by a critical realist toolkit (Bhaskar et al., 2017) of associated tenets, can provide important ground clearing and methodological reasoning. First, Stages 1 to 3 were used to clarify the research ground and to reduce and refine the potential objects of knowledge in this study in Chapter 3. Stage 3 also provided a necessary link between Bhasker's philosophical underlabouring to a 'practical' methodological theory (Archer, 1995). Finally, Stages 4 to 6 supported an analytical framework informing retroductive methodology as it moved between the concrete and the abstract.

Table 4.2: Explanatory model stages and research phases (as suggested by Gable, 2011)

Explanatory Model	Underlabouring direction	Research chapter	Outcome
Stage 1: Theoretical description	How the phenomenon is described in the research base/s? What theoretical perspectives prevail?	Ch 2: Literature review Ch 3: Conceptual framing	Complex and contested research base examined
Stage 2: Meta-theoretical analytical resolution	How am I going to identify important components for empirical research?	Ch 3: Conceptual framing	CR delivers a viable alternative theoretical framework
Stage 3: Abduction/ meta-theoretical redescription	How can conceptualisations be mapped against the meta-theoretical perspectives? Structure (culture) vs agency?	Ch 3: Conceptual framing Ch 4: Methodology and methods	Archer's (1995) realist social theory provides a workable methodological solution
Stage 4: Retroduction	What might be happening? What alternatives (other possibilities) are there to explain the phenomenon?	Ch 5: Analysis	Describes an analytical history of emergence
Stage 5: Comparison between theories	What theories hold the best potential explanation? How do they compare with other theories?	Ch 6: Analysis Ch 7: Analysis	A casing and re-casing protocol is enacted. A hypothetical model is proposed for testing.
Stage 6: Concretisation and contextualisation	Do these findings make sense in the real world? Do they make sense in the research? In what context? Why?	Ch 6: Analysis Ch:7: Analysis and findings Ch:8: Summary and findings	CM(A)O configurations are implemented. Findings and analysis.

This staged process offered the opportunity to test the data against associated theories in the search for the necessary conditions and situational logics that might provide improved explanations of the phenomenon (Danermark et al., 2002). In this respect, the explanatory model was revised to accommodate the complexities of researching complex phenomena by determining an entry point in the research space and refinement of the emergent conditions/properties (Gable, 2011) as well as a reliable research procedural framework. The model is represented in Table 4.2, which captures the modified process, and the questions asked at each stage.

4.4 Critical Realism and Case Study Methodology

Given the complex nature of the phenomenon and the assumptions of a CR perspective adopting a case study approach signals several intentions at the outset. Critical realist-based research seeks to "deliver clear, concise, and empirically supported accounts of causation—specifically what, how and why a phenomenon occurred" (Wynn & Williams, 2012, p.789). As a meta-theory, CR supports several methodologies; however, it is argued here that there are workable synergies and practical outcomes between CR and case study research (Easton, 2010; Wynn & Williams, 2012). In this respect, CR seeks to identify the "structures that give rise to certain powers, tendencies, or ways of acting" (Mingers et al., 2013, p. 796). Similarly, well-constructed case study research relies on identifying causal mechanisms and subsequently "developing a clear understanding of the causal pathway(s) at work in a causal relationship" (Gerring, 2007, p.45). These convergent models support the possibility of peering into the "box of causality" to identify relationships and relational factors lying between some structural cause and its supposed consequence (Gerring, 2007, p. 45). Accordingly, the case study approach and the critical realist paradigm share similar concerns in their desire to identify causation and provide explanation for observed phenomena.

Critical realism is interested in how different mechanisms interact across multiple strata; it is a primary understanding that each "hierarchy of contexts has its own peculiar mechanisms and emergent powers" (Collier, 1994, p. 117). Directing attention to these generative mechanisms and their interaction across different contexts provides "a rich source of explanatory devices" to inform realist studies (Easton, 2010, p. 122). Correspondingly, case study research too supports the empirical study of several structural entities and contextual factors embedded in complex, open-system organisational environments such as educational systems and schools (Wynn & Williams, 2012). Danermark et al. suggest "that comparison (of cases) provides an empirical foundation for retroduction, a foundation to sort out contingent differences in order to arrive at the more common

and more universal" outcome (2002, p. 105). What makes CR comparative case studies so rewarding is the insight afforded by these synergies.

Critical realist case study design recognises two related but discernibly different logics of discovery—the identification of underlying mechanisms across different strata and understanding the conditions of these mechanisms existing and interacting within these strata (Ackroyd, 2009). The interaction between these two logics of discovery (context and causation) closely informed this research as it focused on social processes across several contexts (Elger, 2010), expanding and then contracting attention on research phenomena at different points in time.

This study adopts a definition of case as "a spatially delimited phenomenon (a unit) observed at a single point in time or over some period of time" (Gerring, 2007, p. 19). Here, case studies and the issues associated with the identification of each case are considered pragmatically as part of a research sequence where casing decisions are made in light of the evidence in order to move the analysis along (Ragin, 2009). This temporal attention, aligned with Archer's (1995) "historicity of emergence" refocuses the attention on the evolving nature of the research phenomenon. In this case, the fluid nature of case study research promises some flexibility, while also directing attention to the necessity of a casing strategy that operates over time.

This CR-informed research re-casts case study as an exploration, "utilised not only as a complementary methodological tool to the abstraction process of critical realist research but as a heuristic employing retroduction to focus attention on the phenomenon" (Gable, 2011, p. 123). As it was anticipated that the unit/s of analysis would surface as the research developed, the casing approach did not articulate this at the beginning of the research (VanWynsberghe & Khan, 2007). Here, cases were expected to emerge in order to make sense of the complex empirical evidence, focussing attention on some parts of the evidence while masking others (Ragin, 2009). This is not a passive process but an active engagement with the interplay between theory, method and empirical evidence.

This attention to re-casing or recontextualising is central to the research interest, the impact of data use in schools, and requires situating the study across multiple scales. In this respect, the research phenomenon is positioned in global education spaces, within national and state approaches to education and embedded in people's respective knowledge and understanding. Here then the casing and re-casing process begins in the larger relational unit and moves through the process to the individual. As utilised in this research, casing was expected to "…challenge and re-specify received causal processes. It is used to work out the relationship between ideas and evidence.

Casing purposefully works and reworks cases throughout the research. Interpretations and explanations are always provisional." (Emmel, 2013, p. 107).

Therefore, casing activity is an ongoing part of this research process designed to refine objects of knowledge and test theory, in this case, across several contexts. Here the research is presented as a process of casing that is ever-refining objects of knowledge through abduction and retroduction to identify an appropriate unit of analysis.

4.5 The Morphogenetic Approach

Margaret Archer has made clear her commitment to the ontological underlabouring of critical realism across several decades. There are distinct synergies between the tenets of critical realism and Archer's (1995) realist social theory in the form of the morphogenetic approach for designing research. In this respect, however, both social realism and morphogenesis face similar problems. Here, structures must be identified independently of agential influence, yet still revealing its effects upon them, while accounting for eventual outcomes of either reproduction or transformation of the original structures (Archer, 1995). Archer describes the morphogenetic approach as a methodological complement to CR and a framework of "practical use for those working on substantive sociological problems" (Archer, 2007, p. 39). Accordingly, realist social theory with its accent on explanation rather than prediction, mediated understanding and knowledge, and multiple possible explanations supported the essentials of social enquiry (Thursfield & Hamblett, 2004) which underpin this research project.

The nature of the cyclic, three-stage morphogenetic approach (Archer, 1995) was first explained in Chapter 3. Here the importance of identifying and exploring the emergent properties of structure, culture and agency over cycles of emergence (Horrocks, 2009) is reiterated. Archer (1995) argues that these cycles have a relative autonomy and yet retain the ability to interact with the other, not necessarily at the same time, holding each as a separate entity, then supporting the analysis of the complex interplay of context and causation/mechanisms over time (Herepath, Kitchener, & Waring, 2015). Consequently, the researcher considers the research process in a multi-dimensional way. This understanding best captures how to think about the morphogenetic approach as each set of emergent properties interacts to shape and reshape each other over time and on different strata levels (Archer, 1995).

Accordingly, this research is a structural analysis of a multilayered education system characterised by its virtual depth and made possible by realist social theory and the morphogenetic cycle. It is stratified and organised across several contexts which are distinguished by situational

logics emergent at each level. Here, Archer specifies three relational levels characterised by emergent properties:

> …the three coincide with what is conventionally known as the micro-, meso-, and macro-levels, dealing respectively with the situated action of persons or small groups, because there is no such thing as contextless action; with 'social institutions', the conventional label for organizations with particular remit, such as government, health, education etc. at the meso-level; and with the relationship between structure and culture at the most macroscopic level.

> (Archer, 2014, p. 95)

Each of these strata possesses different emergent properties and powers. Archer (1995) argues that the "key points in this connection are that emergent strata constitute (a) the crucial entities in need of linking by explaining how their causal powers originate and operate, but (b) that such strata do not neatly map onto empirical units of any particular magnitude"(p. 10). In other words, there are no big or small, macro or micro issues as defined by the size of the social unit; understanding is developed across multiple levels and is relational in scope.

Guided by this conceptualisation and foreshadowed in previous chapters (see Chapter 3), a more nuanced understanding of these layers is established here. Following Herepath and colleagues (2015) 'contextual' understanding is formed across four levels: infrastructural system, institutional setting, interpersonal relations and the individual (See Figure 4.1).

The infrastructural system consists of higher-level macro structures, which include societal systems. These include the neoliberalist state, etc. Then come the meso-level structures composed of organisation sectors with a focus on a particular issue or policy community like state governments and education departments. The concept integrates "field-level structures, participating organisations and the people working within and between these organisations" (Herepath et al., 2015, p. 15). In addition, there is the micro-level of the individual organisation, together with intra-organisational levels or groups. This conceptualisation situated the analysis in a stratified context. Herepath et al. (2015) argue that merging with Archer's social realism provides a further understanding of the interplay between the strata as "dynamic, conditioned, relational and temporally fluid" (p. 49).

Accordingly, this model of context supported the visualising of the development of datafication across and within these multiple strata (Sellar, 2017). It recognises that the small-scale data interactions between teachers and principals do not just happen in schools but within larger

education systems and larger still global spaces (Archer, 1995). This model is integral to the research methodology, positioning the analysis across all four strata across the three phases of analysis.
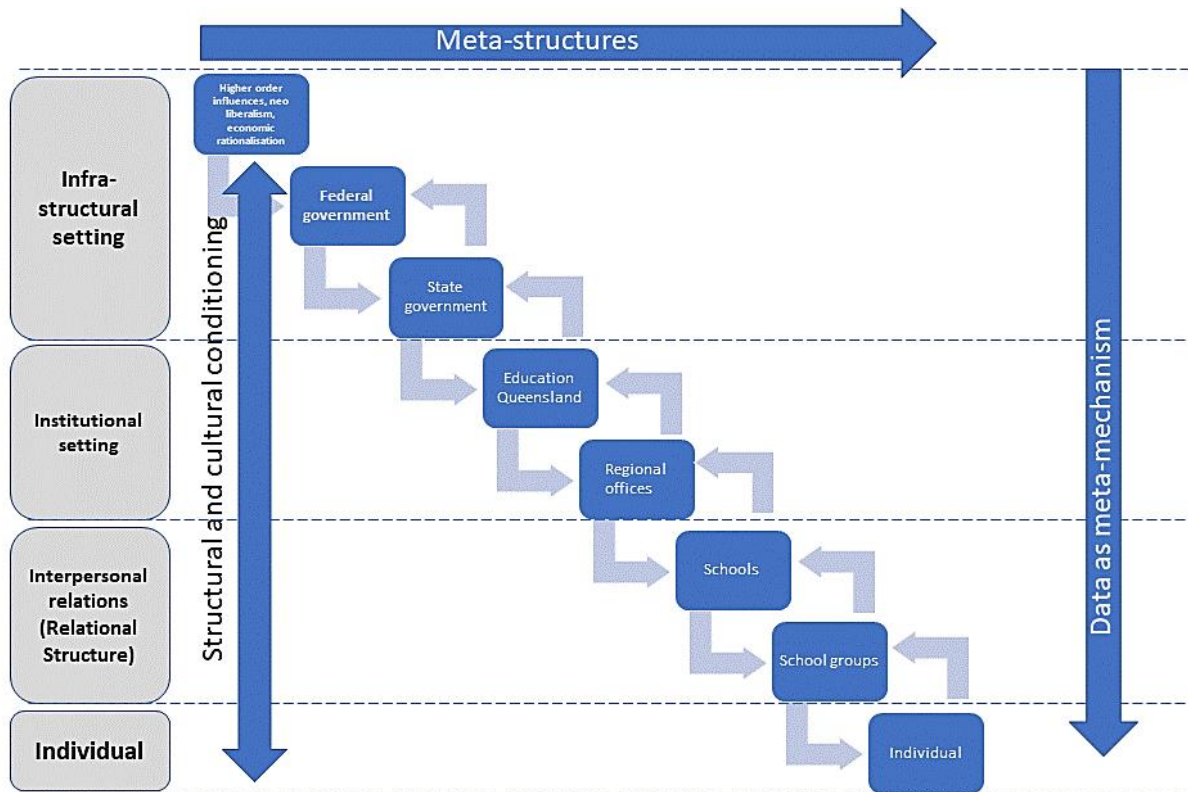
Figure 4.1: Contextual strata: structural/cultural conditioning, hierarchical meta-mechanism (adapted from Herepath et al., 2015)

4.6 Addressing the Challenges of the Morphogenetic Approach

Archer's social realist framework gives equal prominence to structure, culture and agency. Key to this approach is the temporal and contextual understanding that recognises that each of these elements is more or less influential at different moments in time and place. This non-conflationary approach stands in opposition to some previous educational research (see Chapter 3 for further insight), which tended to focus on either agency or structure and culture, or even conflated the three with little respect for the ontological (and methodological) implications. Nevertheless, the adoption of the morphogenetic approach poses a challenge to the researcher. As Archer and colleagues explain:

> …it is a much slower process; we have to disengage and justify precisely what the emergent properties are that we are dealing with on the level of social ontology. We

then have to frame explanatory programs that can utilize these and make warrantable the assertions we are making at the ontological level, and at which simultaneously can be of utility in disentangling the interplay that is going on at the institutional level, the face-to-face level or whatever area of practical social analysis somebody is engaged with. (Archer et al., 1999, p. 14)

During the course of the analysis, it became increasingly clear that each school was at a different phase in the morphogenetic cycle/s contingent upon the causal powers influencing the individual school at any one moment. This observation confirms Archer's (1995, 1996) understanding that the structural and cultural domains of any given social context are often out of phase or *synch* with each other. The practical response to this temporal mismatch is analytical dualism (See Section 3.10). This relationality is both a methodological strength and a research limitation of Archer's approach and will be further discussed in the final chapter. It allows for the formulation of practical social theories, while it prevents an arbitrary overlay of a morphogenetic cycle across several contexts.

The corollary to this enhanced stratified view of social reality is one of increased scope (Archer, 1995) again emphasising how demanding it is to structure research material in an ordered fashion or indeed discuss the causal processes across each of the three levels of the morphogenetic cycles "simultaneously in dynamic contexts, rather than focussing on only one" (Horrocks, 2006, p. 179). Furthermore, analysing what, how and why the various causal mechanisms interacted and what emerged while avoiding deterministic theories of cause and effect was considered challenging.

Subsequently, it is suggested that despite the strengths and the methodological contribution of the morphogenetic approach, a further set of methodological/theoretical tools was required to better specify the outcomes of the interaction of structural and cultural conditioning on agential activity in schools. Here a realist conception of explanation proposed an additional means of establishing causal mechanisms and specifying context in the research (Ackroyd, 2004).

4.7 Realist Enquiry

Realist inquiry is underpinned by a generative model of causation (Ackroyd & Karlsson, 2014; Pawson & Tilley, 1997) which directs research attention to the "identification and examination of the underlying generative mechanisms which shape structure, culture, social relations and accompanying practices that are reproduced and/or transformed" (Herepath et al., 2015, p. 12). Central to this theory is Pawson and Tilley's (1997) concern for the causal vocabulary crucial for the description of any such process of change or reproduction. What is missing from

critical realism's conception of social science, Pawson argues, is the means to "develop useful, policy-relevant hypotheses to 'explain apparent uniformities through seeking out vital generative mechanisms and particularly conducive contexts'" (New, 2001, p. 44). Without a specific practical social theory and a middle-range approach, it is likely difficult (he argues) to produce work-like accounts of the generative mechanisms producing particular outcomes in certain contexts. Researchers should look to "the causal powers of people as the source of agency". Generative mechanisms are then to be found in "the choices people make and in the capacities they derive from group membership" (Carter & New, 2004, p. 14). Simultaneously, and aligned with Archer (1995, 1996), the researcher must also consider how social context might mediate these generative mechanisms and how this mediation might enable, constrain or nullify their action (Carter & New, 2004). The echoes of both CR and the morphogenetic approach are present here; yet, as Pawson (2013) notes, the concerns of both are often more philosophical, and I would add, high-level methodological ones, rather than suited to a practical research project.

Accordingly, the generative paradigm brings a "terminology of transformation" that has implications for the way causation is conceptualised (Pawson & Tilley, 1997, p. 37) in this study. The basic schema of Context (C) + Mechanism (M) = Outcome (O) underpins this analysis. Drawing together a framework for data-use analysis in schools (Coburn & Turner, 2011b) and the means to develop theory-driven, testable propositions of how an intervention is supposed to work (Pawson & Tilley, 2004) relies on the application of these context-mechanism-outcome configurations (CMO configurations). The following sections establish the rationale for realist inquiry and Archerian morphogenesis to examine data use in schools. Pawson and Tilley's generative model of causation with specific variations was adopted to develop a comparative understanding of each school context.

A CMO configuration is a (testable) proposition that hypothesises about activities associated with underpinning mechanisms (M) which function in particular contexts (C). Figure 4.2 visualises how these CMO configurations are constructed. Each addition ($C_1M_1O_1 > C_{1A}M_1O_{1A} > C_{1B}M_1O_{1B}$) is a round of progressive refinement as the object of enquiry is brought more readily into focus. Each iteration supports richer insight into the possibilities and challenges presented by an intervention better to inform new programs and practices in each domain (Pawson & Tilley, 2004). Drawing on the realist underpinnings of their evaluation methodology, bundles of context-methods are extracted from each case and presented in table form for ease of comparison (Harrison & Easton, 2004). This evaluation of processes relies on four linked concepts for explaining and understanding: 'Mechanism' (M), 'Context' (C), 'Outcome pattern' (O), and 'Context-Mechanism-Outcome pattern configuration' (CMOc) (Pawson & Tilley, 2004). In the next section, each of these

terms is defined within a realist understanding aligned with the necessary elaborations associated with a realist social view of the world.

$$C_1M_1O_1 \Rightarrow \quad C_{1A}M_1O_{1A} \quad C_{1B}M_1O_{1B}$$
$$C_{1C}M_1O_{1C} \quad C_{1D}M_1O_{1D}$$
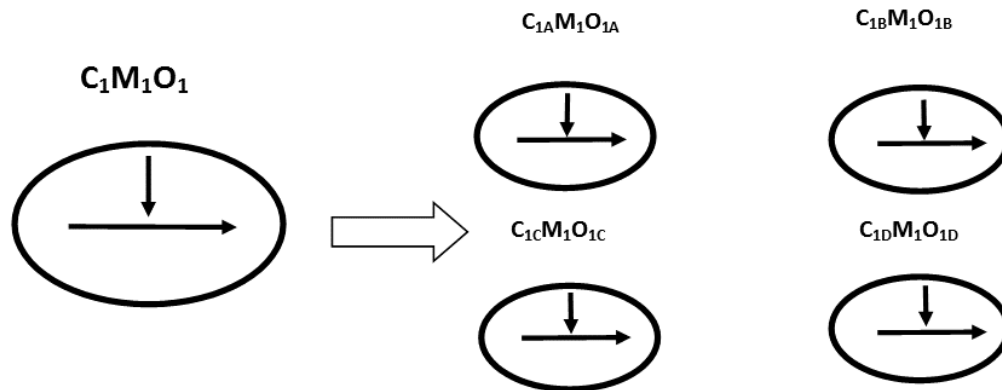
Figure 4.2: CMO pre and post-testing (Pawson, 2013, p. 23)

4.7.1   Mechanism

A mechanism as understood here is the *process* of how subjects interpret and act upon the intervention in question. It is not necessarily singular and in the words of Pawson and Tilley (2004):

> …mechanism refers to the ways in which any one of the components or any set of them, or any step or series of steps brings about change. Mechanisms thus explicate the logic of an intervention; they trace the destiny of a programme theory; they pinpoint the ways in which the resources on offer may permeate the reasoning of the subjects.
>
> (p. 7)

Mechanisms are, therefore, about people's choices and preferences, and the capacities and powers they derive from group membership (Pawson and Tilley, 1997). The interplay of structure, (culture) and agency exists at the heart of sociological explanation, where enquiry reaches 'down' through the layers of individual reasoning (to consider the ideational) and 'up' to the material or collective resources available, to consider degrees of interpretative freedom, directional guidance, opportunity costs and bargaining power (Archer, 1995), in order to determine what might make agents change their minds (Pawson & Tilley, 1997). This link draws together, an Archerian perspective that mapping the interplay between structure, culture and agency is essential, with a recognition that a concrete outcome from this meta-understanding is difficult to come by. Identifying the different social relations as mechanisms and what triggers them is then the basic unit of analysis for understanding causation in these school cases (Pawson & Tilley, 2004).

Pawson and Tilley (1997) argue that these mechanisms are identified by three conditions: the embedded nature of the phenomenon in the stratified nature of social reality, the propositional account of how macro and micro processes constitute the phenomenon, and how outcomes are a result of agents' choices (their reasoning) and their capacity (resources) to put things into practice. Utilising Archer's later work on the mediation of contextual influences Herepath et al. (2015) argues two mechanisms that should be considered: "habituation—the guiding of routine action, and reflexivity—the guiding of action that requires a more creative response" (p.21). These are essential components influencing socio-cultural interaction, and here Herepath et al. (2015) argue that "Reflexive theorisation represents the explicit interplay of social context and person concerns that lies at the heart of Pawson's notion of mechanism"(p. 21). Furthermore, that explanation in social life requires recognition of agency (A) as a separate category. Therefore a CMO configuration becomes a CM(A)O model of explanation (Bhaskar et al., 2017).

4.7.2 Agency

Distinguishing agency in this way recognises agency as evolving from "the *interaction* of individual 'capacity' with environing 'conditions'" (Priestley et al., 2015, p.22). This positions agency as an emergent phenomenon rather than residing in individuals as a property or capacity (Priestley et al., 2015). Therefore, the achievement of agency is seen as the result of "the interplay of individual efforts, available resources and contextual and structural factors as they come together in particular and, and in a sense, always unique situations" (Biesta and Tedder, 2007, p.137). In this respect teacher agency lies, not latent in the individual, but in an active engagement with local environs, it is a developing relationship across time, and it is actively achieved. To develop forms of teacher data agency, therefore, requires an intentionality on the part of the individual, a capacity to engage with the various possibilities and make choices within the constraints and enablements of social, cultural and material structures (Priestley et al, 2015). Foregrounding agency within the CMO configuration makes visible the complex social interactions that may take place when mechanisms and context interact. In this study it recognises the purpose and action that is the basis for transformation (or reproduction) of data practices in schools.

4.7.3 Context

According to Pawson and Tilley (2004), "context describes those features of the conditions in which interventions are introduced that are relevant to the operation of the intervention mechanisms" (p. 7). This is not to be confused with locality. Pawson and Tilley (2004) argue that, while place and space may be significant, the focus might also be systems of interpersonal and social relationships, biology, technology, demography and economic conditions. Here it is the prior

set of social rules, norms, values and inter-relationships drawn together in these contexts, which sets limits on or constrains any mechanism (Pawson & Tilley, 1997). For example, this research considers the 'value' of new data uses and resources introduced into the existing set of social relationships that constitutes a school. Here then, the concern is the extent to which these pre-existing structures can enable or constrain these mechanisms designed for change with the school setting (Pawson & Tilley, 1997).

4.7.4   Outcome

The final stage is to formulate perceived outcome-patterns, which underline the intended and unintended consequences of interventions in particular contexts. These outcome-patterns are drawn from the empirical evidence mapped in the context + mechanism + agent stage. They are the result of the activation of different mechanisms (or the perceived 'same' mechanism) in different contexts (Pawson & Tilley, 2004). It is here we return to the transformation or reproduction of structure, culture and agency or the morphogenesis or stasis of the social context, in this case, the social relations of data use (Archer, 1995). The 'context, mechanism, agency, outcome configuration" —CM(A)Oc—at its simplest is an attempt to test an "if-then" proposition (see Appendix F for exemplar). Pawson argues it is a way to hypothesise, monitor and seek explanation of how the same intervention is "interpreted and acted upon in different ways by different participants in different positions" (Pawson, 2013, p. 11). It is necessary to be aware of the multiple contexts, the conditions that structure the actions of the causal mechanisms and the possibility of alternative outcomes.

Context can be conceptualised in several ways to support research understanding. Realist inquiry describes context as a large set of concentric circles with the program mechanism at the centre (Pawson, 2013, p. 37) encompassing the following contextual layers:

    i.   Individuals – the characteristics and capacities of various stakeholders in the program
   ii.   Interpersonal relations – the stakeholder relationships that carry the program
  iii.   Institutional settings – the rules, norms and customs local to the program
   iv.   Infrastructure – the wider social, economic and cultural settings of the program.

This model, used widely in realist studies in health care, is usually limited to a domain-specific notion of context or alternatively discrete organisational sites (Herepath et al., 2015) which reduces the potential for wider explanatory purchase. Other aspects of context within organisational culture and influence such as leadership and governance also need to be accounted for (Herepath et al., 2015). Accordingly, (following Herepath et al., 2015) this research sought contextual analysis

beyond the spatial, geographical, institutional location of the research sites, in an approach informed by Pawson and Tilley (2004) that describes four levels of contextual hierarchy (infrastructural system, institutional settings, interpersonal relations and the individual. This conceptualisation is represented in Figure 4.1 which contextualises education in Queensland leading up to these educational reforms described in Chapter 5. While these systemic and institutional strata conditioned and shaped the organisational environment, in turn, these effects were mediated by the state-level cultures and agential response at that time. The stepped nature of Figure 4.1 is a visual representation of how the outcome at one level can become the context for the next in a chain of causation (Herepath et al., 2015).

Within the infrastructural and institutional levels, interacting emergent properties manifest themselves as mechanisms and filter down through each setting. At each point, groups of elite corporate agents are provided with good reasons for the enactment of educational policies, spreading and legitimising a particular managerial approach (Archer, 1995). In this case, infrastructural and institutional settings of the education field are seen as relational and possible because of the "stratified nature of social reality where different strata possess different emergent properties and powers" (Archer, 1995, p. 9).

At the highest hierarchical level, the infrastructural system of the Australian education system is structured over three strata: (1) the higher-order conditioning which moulds this contextual space, for example, neoliberalism and the knowledge economy, (2) the Australian Government, as a federal institution, and (3) the Queensland state government as the constituted organisation responsible for education. "The second level of context, the institutional setting, is conceptualised through two strata": (4) Education Queensland, as a corporate whole, and (5) Regional education offices. "The third level, interpersonal relationships, which constitute the relational structure within which actors are embedded, is captured across two further strata": (6) a school site (7) the teachers within a school. The final level (8) "describes the capacities of the individual actors" (adapted from Herepath et al., 2015, p. 20).

To build better connections between these strata, a modified approach situates context as shaped and "contoured by emergent structural, cultural and agential powers across time" (Herepath et al., 2015, p. 19). Accordingly, an Archerian view linked with realist inquiry strengthened the possibilities of uncovering satisfactory explanations in these expanded CM(A)O configuations.

4.8 Research Design

This research theorised about the interplay between the rise of data use in schools, within explicit school improvement and accountability policies, and teacher mediation, via the morphogenetic approach. This directed attention to the social relations potentially emergent from this interaction and drew on a methodological approach that focused on the ways administration staff and teachers engaged in the processes of data use in different organisational contexts. Accordingly, a comparative case study, intensive in design, mapped what Sayer (1992) describes as the "substantial relations of connections"(p. 243) seeking forms of causal explanations. Sayer (1992) argues that an intensive research design provides detailed and representative data when compared with large-scale research (extensive design), which produces an "enormous amount of descriptive results … however explanations are uncertain" (p. 242). In this respect, an intensive case design shaped the research outcomes by examining events across several contextual strata and delivering "context-sensitive causal explanations of specific phenomena" (Wynn & Williams, 2012, p. 804).

4.9 Case Selection

Seeking explanation across different contexts has implications for case selection. Kessler and Bach (2014) suggest that the rationale for the case selection process may be considered as a 'light theorization' and is a feature of multiple case designs. "'Light theorization' is a tentative but plausible account of similarities or differences that might be revealed by the case comparison. For the critical realist, it is likely to rest on a narrative which centres on how structure and agency interact at different levels to produce these similarities and differences" (Kessler & Bach, 2014, p. 174). Accordingly, the role and effects of increased data use on social relations in schools and the potential for school improvement could be "plausibly related" to how structure, culture and agency interact at different levels (Kessler & Bach, 2014) from the federal and state government, the state educational system, the regional office, the school and through to the classroom. To empirically explore this potential interaction, four case schools were 'selected' from two educational regions in Queensland.

Unlike the extensive approach which seeks to find regularities across populations (Sayer, 1992), the sampling process within intensive research design is usually considered to be more strategic. Accordingly, this research sought understanding in the conditions in which particular mechanisms produced different outcomes within each of the research parameters. To facilitate this case selection, a varied sampling process (Danermark et al., 2002) provided the differentiation points, in this instance, geographical location and socio-economic status (see Figure 4.3).

The schools included in this research project were part of a pool of schools identified as meeting four criteria: a state government primary school, metropolitan or rural location, low or high Index of Community Socio-Educational Advantage[9] (ICSEA) and audited in 2013-2014. There were 53 schools in the original pool of potential research sites. Of these, 16 (located in two education regions) were emailed and invited to take part in the research project. Follow-up phone calls were made if there was no reply from the email within two weeks. Recruitment ceased once four schools that met the criteria had agreed to participate. Arrangements were made for school visits. Data collection took place over five months across the four sites.

Rural/Low ICSEA/<50 students Brushbox	Rural/Mid ICSEA/<80 students Corymbia
Queensland State Primary Schools	
Metro/ High ICSEA/800+ students Waterhousia	Metro/Low ICSEA/600+ students Botanica
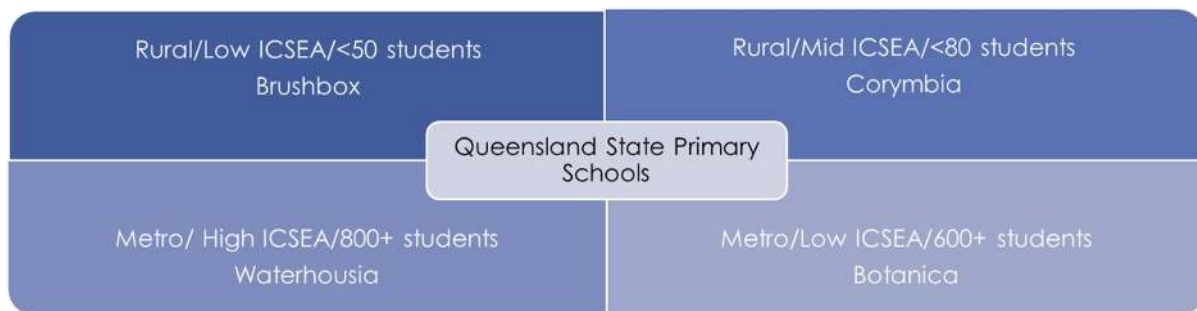
Figure 4.3: Case schools including population and ICSEA

4.10 **Research Question Approach**

A realist-informed study places question design at the very centre of research design as an iterative, creative and ongoing process (Maxwell, 2009). Accordingly, research questions were reflected upon, but only after theoretical considerations and the context of the research design were clarified (Maxwell, 2004). The importance of the underlabouring process and its role in firstly, clearing away and then secondly, shaping and directing the research project, gives credence to the understanding that research questions often emerge and are the result of an interactive design strategy. Inherent is this process is "asking the retroductive research question: what must the context have been like to have allowed the emergence of a given generative mechanism" (Ackroyd & Karlsson, 2014, p.27)? This intensive qualitative case study of the rise of data use in schools is fundamentally about change and what produces it, and this is reflected in the research questions. Accordingly, this research project addresses two categories of research question; the first questions reflect on methodological choices and the second questions relate to the research problem domain.

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[9] The Index of Community Socio-Educational Advantage (**ICSEA**) is a measure that enables meaningful comparisons to be made across schools. It has been developed specifically for the My School website and measures key factors that correlate with educational outcomes (ACARA, 2013, p.1).

4.10.1 Methodological research questions

The methodological research questions endeavoured to explore and reflect on the research process that emerged from the engagement with critical realism and the subsequent adoption of the morphogenetic approach to explore complex phenomena in education research. As such, they consider the intersection between the underlabouring of critical realism and the high-level methodological discourse of the morphogenetic approach. The methodological questions are included below.

- What are the advantages of a critical realist toolkit when researching data use in Queensland primary schools?
- How does the morphogenetic approach support research into agential transformation in education?

4.10.2 Domain-focused research questions

The research project adopted a questioning approach which accounts for a critical/social realist understanding of this complex phenomenon with an explicit focus on the interaction of structure, culture and agency. Accordingly, explanation might lie in considering the social dynamics as outlined in the morphogenetic approach where "the identification and temporal mapping of relations between social and cultural structures via or through descriptions of social and socio-cultural agential interaction" (Lipscomb, 2014, p. 41). Nevertheless, at any one point within a system, multiple social relations and relationships mean that a number of differently organised contests might be occurring (Scott, 2000). Here these structural and cultural properties do not automatically carry with them the benefits or the challenges which might enable (or constrain) agents as role-holders to behave in certain ways (Scott, 2000). Agents may reproduce or subvert the role, by accepting or rejecting the perceived benefits inherent in the role, or they may be either oblivious of them or understand them in a different way not originally set down in the role (Scott, 2000).

How these relationships emerge depends up to a point on the different degrees of knowledgeability of different agents. It is the amount and type of knowledge held by agents in any particular situation which can contribute to the outcome of the interaction between structure, cultural and agency (Scott, 2013). Subsequently, knowledge and degrees of knowing of agents must be accounted for within this methodological framework. While this artificially isolates knowing and knowledgeability, it promises productive insight into the new relations emerging from increased data use in education.

Domain-focused research questions were drawn from social dynamics outlined through the morphogenetic model explained above. In this respect, agent action was characterised as intentional, yet reliant on degrees of knowledgeability. Therefore, informally, agents might make decisions based upon what they know, what they know and disregard, what they think they know, and what they do not know. Here intentionality is mediated by structural and cultural conditioning of the social world. These dynamics are described in Appendix A, which mapped these elements of relational properties and perceptions/interpretations of social relations and relationships across a matrix of emergent properties. Consequently, the research questions drawn from this framing are articulated below.

- What pre-existing structural and cultural conditions influence the way data is used in Queensland primary schools?
- What are the key dimensions of data use in Queensland primary schools?
- How does engagement with data inform professional practice and teacher learning in primary school contexts?
- How might data use constrain or enable principal-teacher agency within the Queensland state primary school environment?

4.11 Research Design and Data Collection

Archer's (1995) morphogenetic approach furnished the theoretical rationale for the choice of research and data analysis methods. Methodologically, it established the forms of structural, cultural and agential relations and the nature of socio-cultural interaction between those relations encountered within each school site (Lipscomb, 2014). This is the basis for the comparison of causal mechanisms across school sites. This study employed a document review, interviews, field notes and theoretical memos in a multi-methods strategic approach (Layder, 1993) to data collection, increasing the potential for theory generation.

Generally, theories of reality inform methodology and methodology drives methods of data collection; in this respect, the value of the ontological-methodological link is recognised (Danermark et al., 2002). Recalling the morphogenetic framework, different data provided insight at different phases of the research project. Research stages and data collection points are identified in Table 4.3. An initial (and ongoing) document review sourced public documents available from both government agencies and school websites to establish the structural and cultural influences at the structural and cultural conditioning phase.

Table 4.3: Case Study-Four school sites

RESEARCH STAGE	DATA COLLECTION	ACTUAL PARTICIPANTS
Framing the study	Document analysis	Ongoing
Establishing a research relationship: School contact	Initial contact with principal Field notes	Four schools/ four principals
Interviews for understanding	Semi-structured interviews Field notes	Four principals (2 teaching principals) Two deputies One HOC/ three MTs Eight teachers

Planned interviews with participants in each research context also provided reference points for this phase. These interviews canvassed the social and socio-cultural interaction phases and afforded insight into the end/beginning phase at where structural/cultural elaboration or reproduction takes place. The field notes served as adjunct understandings of the interview process (carried out over five months) and general observations of each case site. The analytic memos were comprehensive explanations of the implications of the data and their theoretical propositions (Layder, 1993) and were an invaluable record of the research project. The next section discusses the data collection processes in more detail and makes explicit connections with the practical theorising necessary to begin the data analysis phase.

4.11.1 Document analysis

Document analysis acted as a complementary process to interviews, encouraging what Layder (1998) calls "a genuine interchange and dialogue between methods and strategies, sources and techniques" (p. 69). To understand a school context at T_1, (the structural conditioning phase in the morphogenetic cycle), a series of documents available to the public (policy and procedure documents, media reports, school reports, reviews and newsletters) was collected. Other documents proffered by participants in the course of school visits (process documents and policy outlines) were included in the collection. Education trends and policies are continually shifting and consequently, a current understanding of these changes was a necessity. In some ways, this constant change challenges Archer's morphogenetic cycle, which relies on the temporal dimension to anchor the cycle in a time and context. This is discussed further in Chapter 5 and 8; however, for the present, it should be recognised that the document analysis phase continued to be important throughout the research project.

The documents collected served at least two purposes. First, they provided insight into the structures that may or may not have been influencing social processes and mechanisms at the multiple levels of organisational life. For example, the document analysis which utilised template analysis was able to identify different agencies (including government departments) that had a role in administering and supporting school improvement processes being initiated in schools. Second, the documentary analysis provided another source of evidence to ensure that an "overly empiricist analysis locked in the 'here and now' of participants' perceptions" (Stark & Torrance, 2005, p. 35) was avoided. Collecting documents from "outside" the individual cases developed a multilayered understanding of the research phenomena across the different contexts.

4.11.2 Interviews

Participants were invited and interviewed based on their position/role and their potential interests and insights into the types of interactions and relations that may or may not be emergent at the school site. The initial aim was to recruit a cross-section of the school community including the principal, deputy principal, master teacher[10] (if present) and up to four teachers in each school (both experienced and early career teachers). However, this was not always possible for several reasons.

First, as two of the schools were small rural sites, their staff sizes (including the teaching principal) were two and five respectively. Second, in the larger schools it was relatively easy to invite the administration staff to take part because access was simple (they were located in the administration space); however, arranging time with the teaching staff was more problematic as they were separated in classrooms. Third, the availability of the teachers was often compromised, as they were too busy to take part in an interview. However, with perseverance and support from the administration staff, teaching staff from each school site were interviewed. Again, participants self-selected once they had responded to the invitation to take part in the research. In two cases, the teachers within the school responded to an invitation via the principal to take part in an interview. In the third school, the Master Teacher approached a cross-section of the teachers that he was working with and offered an invitation to take part. In the fourth school, a notice was placed in the in-house school newsletter, inviting participants to take part.

Sixteen participants were interviewed representing five different positions within the school case sites: principal, deputy principal, Head of Curriculum (HOD), Master Teacher (MT) and classroom teacher. At least two participants held two positions (classroom teacher and HOC or

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[10] A Master Teacher position is an additional classified teaching position provided to selected Queensland state schools to help improve student outcomes (Education Queensland, 2016)

MT). Consequently, all position descriptions were filled, allowing a cross-section of each school staff to contribute their understanding to the study.

The table below details number of interviews disaggregated according to role within each school.

Table 4.4: Case site interviews according to role in school

Case site	Principal (n = interviews)	Deputy principal (n=interviews)[11]	Master teacher-Head of curriculum (n=interviews)	Teachers (n=interviews)
Brushbox	1			1
Corymbia	1		1	3
Botanica	1		1	3
Waterhousia	1	1	1	1

This study used interviews as a qualitative data source as they offer "direct access to the point of view of the interviewees" (Edwards et al., 2014, p. 110), in terms of their outlook on life and their lived experiences (Alvesson, 2010). The purpose of each interview was to elicit information about the participants' beliefs and understandings of the ways data use might be changing the way they worked with each other and in the classroom. A second goal was to illuminate how structural and cultural properties might be interacting at an agential level. The third goal was to examine the notion of causality and consider the possibility that "reasons can be causes" (see Chapter 3). A final goal was to determine if the context in which the participant was situated influenced what was happening. A specific CR approach to interviews recognises the importance of meaning construction and interpersonal interaction amongst human actors, as both a means of investigation and as an essential method of research and theory development. This does not generally differ from an interpretivist's approach; however, as a proponent of CR, it is recognised that the interview is taking place in a wider context of social relations and structures and that these potential structures can have enabling and/or constraining effects on the outcomes of the process (Edwards et al., 2014).

The critical realist acknowledges the potential in the interview process to not only understand the how and why, and the interpretations of the participant, but also to evaluate what the interviewee is saying within a wider context, one that recognises competing accounts of social reality. It is this reflexivity and what Smith and Elger (2014, p. 115) call the "critical appraisal of the adequacy of informants' accounts and explanations" that have been at the core of this research

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[11] NB Brushbox and Corymbias' school populations did not warrant a deputy principal position. Extra support was provided by itinerant staff who performed different roles. For example curriculum support.

approach. An interview approach driven by theory (see Pawson and Tilley (2004) and Layder (1998) for their understanding of this) offered the potential for a more explicit understanding of the phenomena being studied. Accordingly, critical assessment, active review and an analytic understanding of the interview process are critical tools in the researcher's toolbox. Moreover, while the interview process as a means for data collection is problematic, it is a prerequisite for CR-informed research. As Egbo explains:

> At its core, critical realism rests on the assumption that the accounts of research participants are valid social scientific data that can lead to consequential social transformation if properly interpreted. Under this arrangement, positive social transformation begins with policies that acknowledge the views, values, and intentions of social actors as presented in their own accounts.

(2005, p. 271)

This lies at the heart of the rationale for semi-structured interviews as primary sources of data for social science research. The interview guide was initially developed following the research design process and engagement with the ethics process (some examples of questions are included in Appendix A). The interviews were one-to-one, which allowed participants to freely explore their understanding of the research topic in as little or as much detail as they were able. The interviews were digitally recorded with the participant's permission and lasted between 25 minutes and 1hr and 30 minutes. The interview recordings were transcribed and provisionally organised in preparation for coding. In each of the interview situations, private space was negotiated on the school site. Most of the administration staff had a single-use office in which the interview took place. Interviews with teaching staff took place in classrooms, in the library, the staffroom and, in one case; under a tree after bus duty.

The interviews were carried out over five months, and while the semi-structured questions guided each interview, there was always potential for the conversation to develop and follow a new idea. Layder (1998) calls this a 'key interview' in which several ideas can come together through the revelation of new information provided by the interviewee. The data from these key interviews served to further inform future interviews with participants in other contexts. In this way, interviews not only provide narrative accounts of a particular event or happening (Edwards et al., 2014), they also encourage insights into the events and experiences and the complex interplay between structure, culture and agency and the generative mechanisms at work within the research context.

4.11.3 Field notes

A field journal was kept which served to record observations, conversations, physical descriptions of schools, in addition to recording thoughts and impressions after each school visit and interview. These field notes were considered 'raw' data (Schwandt, 2007) largely kept as an aide-memoire as well as used to inform the writing of theoretical memos that followed this stage of data collection. This recognised field note recording as both a dynamic and interpretative process, one that takes place over time and is filtered through my own interpretative processes (Schwandt, 2007). Each record required a level of reflexivity when analysing and developing a final understanding of the phenomena.

4.11.4 Data analysis

Data analysis co-opted several approaches. A data synthesis approach known as template analysis (King, 2004) was adopted (see Appendix B). To develop a more granular understanding, Layder's (1998) adaptive theory provided an enhanced schema of theory elaboration. Finally, to identify the interactions between structural and cultural conditions and agents in different contexts, an explanatory model of critical realism (Danermark et al., 2002) was used (see Section 4.3).

Archer's (1995) morphogenetic methodology used here to inform analysis provided a theoretical framework that transformed data into empirical evidence. The social conditioning–social interaction and cultural conditioning–socio-cultural interaction models that were used to analyse the data were described in Chapter 3. The model/s assumes internal and necessary relations within and between existing social structures (and cultural systems) and are (more importantly) identifiable to the researcher (Lipscomb, 2014). Data collected to investigate these relations have come from interviews, document analysis and field notes with the interview transcripts providing the bulk of the evidence.

Archer does not provide the operational means to move from data to explanation. To make this process more transparent, I returned to Danermark and colleagues' (2002) explanatory model, which provides guidelines for the structuring of the research process. As previously outlined (see section 4.3), this six-stage model works from the concrete, through a series of abstractions at different levels, and then returns to the concrete in the last stage. The generation of a series of models of social reality and the identification of the agency-system interlocks and linkages, which provide insight into what was happening at the empirical level and why, (Layder, 1998) were outcomes of working with this model.

In order to provide a more granular interpretation of the data/evidence, a synthesis tool known as template analysis was adopted. This has been used previously in empirical studies (see King, 2004; Lipscomb, 2014) designed to develop understanding of health organisations. King (2004) suggests that:

> Template analysis works very well in studies which seek to examine the perspectives of different groups within an organizational context—for example, different professions working in a collaborative setting, or different grades of staff affected by a particular organizational change.

(p. 268)

Template analysis is not a single, clearly delineated model or method. It is a related group of techniques that assist the researcher to thematically organise and analyse textual data (Brooks & King, 2014; King, 2004). Template analysis requires the researcher to create a series of codes (a template), which represent themes identified usually before the researcher begins to work with the data. These codes are then added to and modified as the researcher develops relationships between data and theory (King, 2004).

One of the benefits of template analysis is the potential to uncover underlying causes of action without overly constraining the research within a limiting framework (Lipscomb, 2014). Here, flexibility was a useful trait when considering the different contexts and the constantly shifting educational landscape in which the research took place. A second benefit is that template analysis offers the capacity to organise larger numbers of transcripts and other empirical data. This is an advantage as previous studies, (Dobson et al. 2013; Horrocks, 2009) using the morphogenetic approach, have indicated the large quantity of data amassed in the search for emergent properties and connections can make the process overwhelming. The third value of template analysis is that it provides the necessary link between the methodological underpinnings of Archer's (1995) morphogenetic approach and the practical empirical demands of documenting a research project.

A preliminary analysis of data was incorporated in the data collection process in order to begin making sense of the "mass of data that accumulates" (Layder, 1998, p. 52). This process involved precoding to develop some broad ideas around the data. Some of these codes were situated in *a priori* theoretical understandings, and others were the result of what Layder (1998) calls 'a triggering of association with an idea or concept'. This baseline understanding also drew from a framework developed by Coburn and Turner (2011b) describing the practices of data use. Care was taken to avoid being too prescriptive in this early stage, as having too many predefined codes can

hamper analysis and may service preconceived notions of what the data should/could look like. Alternatively, as King (2004) advises, too few codes can leave the researcher floundering without any sense of direction and overwhelmed by the sheer mass of data. The initial tentative template incorporating these provisional codes (see Appendix B) was flexible, which was advantageous. What it facilitated was the beginnings of a three-way conversation between data, extant theory and emergent theory.

In the emerging theory development process, Layder (1998) suggests that "precoding and provisional coding are potential conduits to extant theoretical ideas which can be brought to bear upon the emerging theory"(p. 55). This complementary process ruled out the researcher being restricted to only theory that emerges from the data; in this respect, CR supports the idea of data analysis situated in and traceable back to theory.

The complexities of developing a series of templates and the staged nature of the processes made NVivo a useful tool for this stage. NVivo software supported the development of nodes (codes/themes) and sub-nodes (sub-codes/sub-themes) supporting the hierarchical coding process of template analysis. Nodes/codes can be shifted, deleted or recoded depending on which the direction the research proceeds. As a qualitative research tool, NVivo supports the visualisation of the possible linkages between data, influential mechanisms and causal linkage models and is complementary to the processes of retroduction and abduction (Olsen, 2004). While NVivo does not make any judgements about the data (Gibbs, 2007), it is a sophisticated tool that allows the researcher to organise data, to store data, to work more efficiently with data and to visualise data better when exploring relationships and conceptual understandings. In this respect, NVivo acted as a useful research audit trail instrument providing reassurance to the researcher that all possibilities were investigated.

As part of the analysis, research memo writing supported both documentation and theory generation. Layder (1998) makes explicit this important connection between coding and theory generation when he comments:

> Memo-writing is therefore meant to generate discussion and self-dialogue which fashions a conjunction between theoretical reflection and the practical issues surrounding data collection and analysis…Memos provide a means of exploring and teasing out whether or in what sense particular codes, concepts and categories really are illustrated (indicated) by data.

(p. 59)

Theoretical memos traced the research across the six stages of the explanatory model, moving between the concrete and the abstract and back to the concrete, supporting the researcher in the search for explanatory purchase. This model specifically refers to building conceptual models and theories around structures and relations and then placing them in new contexts of ideas. This is similar to the template process in which each version of the template is situated in a growing set of data.

4.12 Ethical Research

Interviews with administration and teaching staff of four schools formed a major part of my empirical data. Recruitment of participants, the conduct of interviews and data use and storage all produce ethical considerations that need to be addressed from the beginning of the research process. Four main ethical concepts informed data collection: informed consent, confidentiality, consequences for participants and the role of the researcher. Each of these concepts was disaggregated, and the process the participants were invited to take part in was questioned. The initial engagement with the context and content of the interviews suggested that the risk to research participants might be minimal. The individuals being interviewed were not believed to be particularly vulnerable and the research topic, while topical, was not considered sensitive in nature. However, school workplaces are complex environments where constant interaction between staff members takes place, particularly in smaller schools. Consequently, the power imbalances between staff members, the possible conflict between colleagues, tensions and worker vulnerability as potential issues needed to be addressed.

The idea of learning to "thicken" events is one that Kvale and Brinkmann (2009) suggest assists the novice to become a more ethically astute researcher. Thickening events to help the researcher act morally includes: contextualising events in their research context, providing a narrative that is situated in a time and place, understanding the particularity of a place and time and recognising one's place in a larger community of practice built around ethical research behaviour, with the potential to learn from that community (Kvale & Brinkmann, 2009). With this in mind, the differing research contexts were carefully considered during both the recruitment and interview phase. The close attention to how the people being interviewed responded to the line of questioning was a key part of building trust and building comfortable relations during the research process.

This mindfulness encapsulates an active way of ethical thinking that suggests an understanding of the multi-levels of interaction in a research space with recognition of the reality of a busy school environment (Thompson, 2015). The "busyness" of a school had to be considered on more than one occasion. A flexible approach was paramount when negotiating access to research

"partners" and setting up a time for interviews with participants. More than once, interview times were adjusted, and in one case, the interview did not occur because it became obvious that the person in question was not interested in taking part in the research.

Key to this research has been identifying causal mechanisms, in particular, educational contexts by examining the interplay between structure, culture and agency. As interviews with staff from schools were a central means of data collection, there were several ethical requirements that needed to be met before the research took place. This research project required approval from the School of Education Ethics Committee at the University of Queensland. An application form for Ethical Clearance for Research Involving Human Participants was submitted and on receiving approval a research application to carry out research on four school sites was submitted to the Research Office at Education Queensland. A final stage in the process was to gain approval from school principals to complete the research on individual school sites (see Appendices F).

4.13 **Summary**

This chapter has described the critical realist comparative case study approach taken in this study. It has argued that Archer's morphogenetic approach provides the means to develop a conceptual framework to analyse the nature and transformation of social relations in schools informed by the rapid emergence of data use as the architect of new arrangements of school improvement and accountability. This understanding situates the study within the critical realist concepts of 'stratification', 'analytical dualism' and 'emergence' and traces the epistemological thinking and the methodological steps that were taken to develop this critical account. It has outlined the practical actions taken to develop an understanding of how new social relations emerged from the causal processes operating at the levels of structure, culture and agency in schools.

This chapter has provided an account of the theoretical and practical considerations necessary to adopt a critical realism orientation when carrying out this research. It has explored the elements of critical realism that make possible knowledge at an ontological level, rather than the reduced knowledge from observation of events (Danermark et al., 2002). This high-level philosophical discourse has, in turn, served a high-level methodological discourse in the form of Archer's (1995) morphogenetic theory.

The acknowledgement of the role of morphogenetic methodology in the research process has driven the use of middle-range theory to examine possible generative mechanisms (Layder, 2006; Lipscomb, 2014). These potential generative mechanisms were viewed through the lens of

ontological stratification in the form of the structural, cultural and people-emergent properties of school improvement, social relations and data use. Developing an intensive case study supported by a social realist approach draws critically on realist enquiry to support a more nuanced understanding of context, mechanism and agency. In this respect, a contextual strata framework was developed to situate data analysis and research outcomes. Data analysis was then presented across four strata in an ever- reducing focus from the infrastructural through to the individual stratum. This narrowing of the research gaze was supported by Archer's (1995) understanding of how emergent entities whose "distinctive relational properties and powers condition subsequent educational interaction (and processes and patterns of change)" in different ways (p. 7). Here the interaction of structural, cultural and agential relational properties was examined at each strata level in the search for generative mechanisms and associated causality.

The research question strategy was detailed, and consideration was given to the connection between theory, data and research question generation across the span of a research project. In this respect, research questions emerged from the underlabouring process and subsequent reflection on theoretical considerations and practical research outcomes of researching in an open social system. As a result, methodological questions were also included to consider the merits (and challenges) of the CR-informed morphogenetic methodology incorporated here.

The chapter also provided a detailed reconstruction of the data collection process and tools, alongside the data analysis process. It has advanced a justification for the utilisation of the critical realist-informed comparative case study and it has detailed the case sampling process. The utility of the six-stage explanatory process for designing retroductive research was foregrounded and the rationale for the adoption of the CM(A)O configurations was advanced. Finally, the ethical considerations of the research were examined and the practical processes that supported ethical research design were also discussed.

5. A Morphogenetic Account–Contextual Analysis

5.1   Introduction

This chapter takes a broader macro-meso approach to the research context in order to establish the Australian educational context, before further refinement in the following chapters. There are three aims for this chapter. The first aim is to describe and explain how the interactions between the structural and cultural arrangements in the Australian education context (the outcome of previous morphogenetic cycles) and the properties of the macro (infrastructural) and the meso (institutional) contexts conditioned and shaped the environment the teachers in this study entered each day. Second, in developing an analytic history of emergence across several contexts, macro (infrastructural), meso (institutional) and micro (relational and individual) contexts first identified in Chapter 3 will be refined. Early analysis indicated the need for a framework that established a richer explanatory story. To clarify this contextual understanding the chapter explores the analytical distinction between structure (funding and policy development) and culture (the underlying ideas and discourses) at a macro level by detailing the nature of changes that have driven a transformed way of thinking about education and its new relationship with society on a global, national and state level.

This chapter builds an understanding of the systemic and institutional properties that were influential at the infrastructural and institutional levels introduced earlier in Chapter 1. The identification of these structures is a preliminary exercise that anticipates the second and third stages of analysis which examine teachers' responses to new data arrangements in schools. There are two sections to this chapter. Part literature review, part document analysis, the first section is an analytic history of emergence that utilises the morphogenetic three-part sequential schema of Socio-Cultural Conditioning → Socio-Cultural Interaction → Socio-Cultural Elaboration or Stasis[12] to trace educational policy trajectory through previous decades at a federal and state level in Australia. The second section incorporates Stages 4 and 5 of the earlier explanatory model (see Chapters 2, 3 and 4). In doing so, it engages in the process of theory building that accounts for research outcomes with present theories or formulating new theories generated from data analysis (Bhaskar et al., 2017). This adaptive process bridged the gap between the high-level methodological discourse of the morphogenetic approach and the 'empirical theories' associated with practical research

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[12] Willmott (2002) uses this shortened representation of the morphogenetic sequence for in-text representation.

undertakings with the outcome possibly being novel, conceptual understandings and insights (Layder, 1998).

This chapter aimed to answer the initial research question:

1. What pre-existing cultural and structural conditions influence data use in Queensland primary schools?

This chapter supports an understanding of "why things structural, cultural or agential are so and not otherwise, at a given moment" (Archer, 1995, p. 344). This approach established the groundwork for Chapters 6 and 7, where outcomes for agents in schools were examined.

5.2 Data analysis initial context

The chapter presented here is an analytic history of emergence, underpinned by two approaches to qualitative research analysis, template analysis (King, 2004), and a data reduction, data display and a conclusion drawing (or verification) approach articulated by Miles and Huberman (1994). Here template analysis attempts to gradually refine the researcher's understanding of the phenomena at hand. The Miles and Huberman (1994) approach furnishes the analytical tools to do this by supporting three concurrent flows of analysis activity.

Data reduction is characterised by selecting codes, concentrating, abstracting and then transforming the data, in this instance it took the form of analytical memos as the literature and document analysis progressed (Miles and Huberman, 1994). Each new memo provided a *new* opportunity to further reduce and cluster themes in an iterative process that intertwined back on itself at various points. To support this analysis, data displays offered the opportunity to assemble data into an accessible, sometimes compressed *visualisation* of information. Here the creation of displays (see Figure 5.1) is considered part of the analysis process and it should be recognised as a part inventive, part innovative process that requires a "self-conscious and iterative" approach to each production (Miles and Huberman, 1994, p.11). The third concurrent stream of activity is conclusion drawing and verification, which involves a long process of deciding "what things mean"? In this research, it is about noting regularities, explanations, causal flows and then making tentative propositions (Miles and Huberman, 1994). Accordingly, the end of this chapter offers a tentative hypothetical model that moves the analysis forward to test the model for plausibility in the next chapter.

A structural analysis of infrastructural and institutional settings engaged with current literature, policy documents, data sites (including MySchool), governance documents and historical

artefacts. Theoretical guidance was provided by Archer's (1995) morphogenetic approach which supported an understanding of the mediatory processes that inform structural and cultural conditioning. Here as discussed in Chapter 4, structural and cultural influences (the generative powers of structural and cultural emergent properties) are treated as indicators which are used to code the identified documents and websites. This analysis then considered the *real* effects of each of the structured situations from a morphogenetic perspective, this included the vested interests, the opportunity costs, the degrees of interpretative freedom and the directional guidance afforded agents at each level. Here constraints and enablements are not considered separate from structures and cultures but are the embodiment, the situational expressions of the bridges or obstructions that support or impede agent action (Archer, 1995).

As this chapter focused on previous macro structural and cultural conditioning (T^1) influencing data use in schools, all artefacts were considered from the structural and cultural emergent properties and coded accordingly. These were categorised under the pre-set concepts of system integration and social integration.

SYSTEM INTEGRATION	SOCIAL INTEGRATION
Distinctive emergent properties (SEPs and CEPs school improvement, leadership, accountability, data use)	Different PEPs, Human beings, actors and agents, teachers and principals
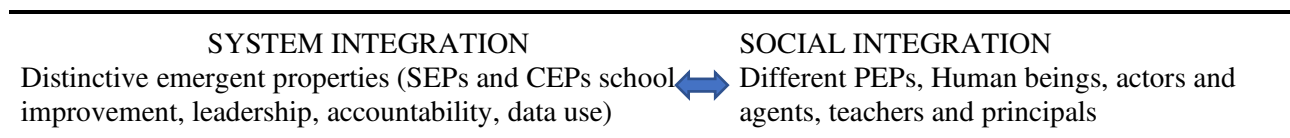
Figure 5.1: Initial coding possibilities

Once coded, an analytic memo was created that aggregated accounts of each structural and cultural emergent property. On completion of coding, each structural and cultural property summary sheet was re-considered against the original research questions and tested against tentative theoretical perspectives. The actual findings were then re-presented as an analytical history of emergence which draws together the above analysis into a structured form, the outcome an explanatory methodology from which emerges an understanding of the educational context in which agents found themselves. In this way data, evidence and theory remain entwined in a constant flow of research activity. These preliminary abstractions emerged as distinctive properties to be further elaborated on in Chapter 6.

5.3   Establishing Contextual Strata

Education systems are stratified by nature; subsequently, processes of data use are experienced by individuals and groups at multiple levels of these systems (Coburn & Turner, 2011b). Accordingly, this analysis (see section 4.5) establishes a 'contextual' understanding of data use in education across four levels: infrastructural system, institutional setting, interpersonal relations and the individual (See Figure 5.1) (Herepath et al., 2015). As explained in the previous chapter, this understanding does not reduce context to a spatial, geographical or institutional

location (Herepath et al., 2015). Here, a scaffolded progression visualises the development of data use across and within these multiple strata (Sellar, 2017). The outcome recognises that the small-scale data interactions between teachers and principals do not just happen in schools but within larger education systems, and still larger global spaces (Archer, 1995).

Part One of this chapter explores the prior structural and cultural conditioning and shaping of the Australian and state education contexts. It examines the systemic and institutional properties which conditioned and shaped the environment of agents in the infrastructural and institutional settings. Figure 5.1 visualises the scope of this analysis. (Please note: setting and morphogenetic designations are representations only.)
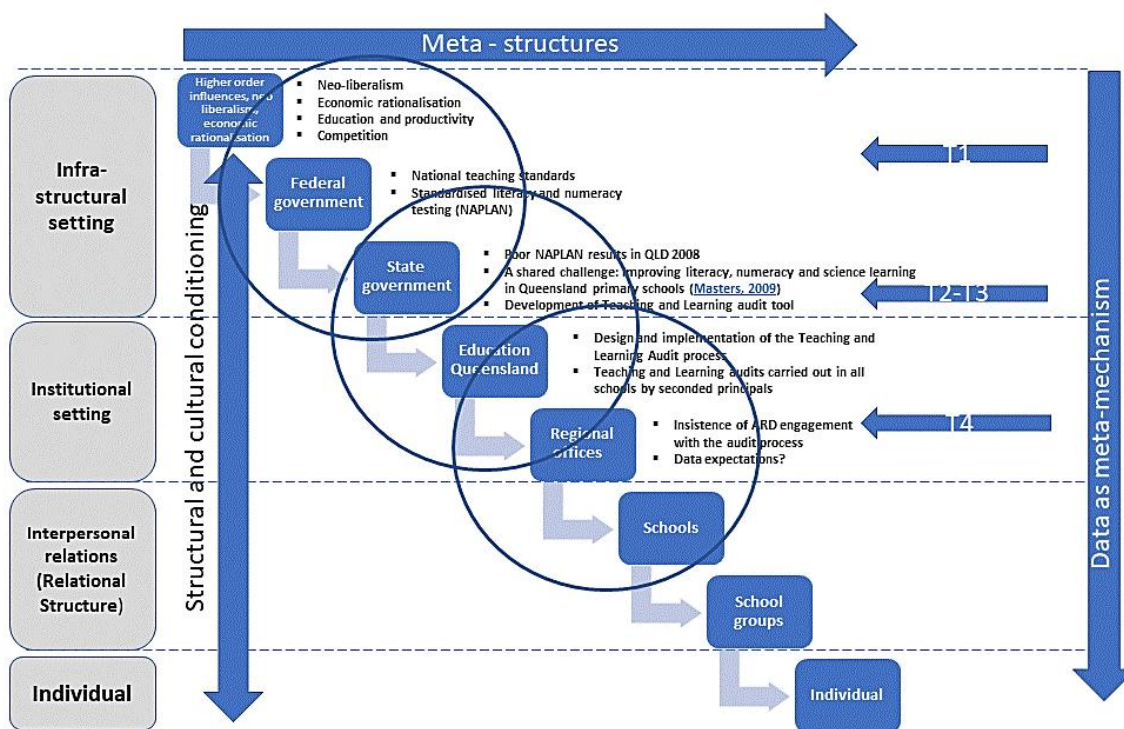
Figure 5.2: Structural and cultural emergent properties across infrastructural setting (adapted from Herepath et al., 2015)

5.3.1 Global policyscapes and the rise of data

This analysis of the macro-political (infrastructural) setting of the rise of data use draws on several theoretical perspectives. Carney's (2009; 2012) understanding of an educational policyscape conceptualises the complex and sometimes disruptive flows of education policy in an era of widespread globalisation (Savage & O'Connor, 2015). Carney's vision, while adopting the notions similar to others who describe neoliberalist movements in education as a particular set of visions, values and ideologies firmly implanted in an economic understanding of education, deviates from these as a sweeping force (Rizvi & Lingard, 2010). Instead, his arguments support Rizvi and

Lingard (2010) who assert that despite similarities across the globe in economic drivers and pressure for transformation, "the reforms which result always have a vernacular character as they build incrementally on what has gone before within specific educational systems" (p. 97).

Accordingly, these global policyscapes (Carney, 2009; Carney, 2012) are manifested and enacted in different ways and different national spaces (Savage & O'Connor, 2015). Carney (2009) considers each nation and each national educational system subject to parallel global influences. However, he recognises, like Archer (1984), that there are local evolution and manoeuvrings that result in distinctive manifestations and different conditions of possibility for reform (Savage & O'Connor, 2015). What results is characteristic of a particular nation and in the case of Australia, particular states, where the individual state is constitutionally responsible for education.

A further perspective introduces educational imaginaries as powerful mediators of agents' perceptions of what education is and what it should be. Barone and Lash (2006) argue that educational imaginaries are "a kind of spotlight aimed at certain features of educational agents and institutions" often depicting "deficiencies within today's institutions of schooling (e.g., public schools and teacher education institutions) and educational agents (e.g., administrators, students, and teacher educators." (Barone & Lash, 2006, p. 22). Accordingly, they operate across different societal levels, yet they are not consistently acknowledged and are often responsible for commonly perceived conceptions and problems about the state of educational systems on all levels and how to resolve them.

In an Australian context, Dinham (2015) argues that these myths, 'facts' or beliefs underpinning the 'crisis' in education in Australia and elsewhere are typified by the following sample of media, community and political commentary:

"Public education is failing"

"Greater accountability will lift public school results"

"International testing is a true barometer of the decline in public schooling"

"The teacher is the biggest influence on student achievement"

"Teacher education is ineffective, and the value of a teaching credential is questionable" (p. 3)

Accordingly, while research evidence does not support the 'beliefs' detailed above, there continues to be agents and organisations with vested interests advocating and actively promoting them

(Dinham, 2015). In a neoliberalist and governance context, education choice, competition, privatisation, transparency and accountability are considered the answers to many questions about education policy (Ball, 1998, 2008, 2009; Dinham, 2015; Lingard, 2010). Change has become the mantra of the day and the call for educational reform is widespread. These views and beliefs are articulated in a number of powerful, interconnected phenomena in Australian education concentrated upon mechanisms for changed school reform and funding, teacher quality, data and data infrastructure, school governance and leadership, and school improvement and accountability (Dinham, 2015; Lingard, Sellar, & Savage, 2014).

5.3.2 A 'datafied' world

The outcome of these global and regional perspectives is hybrid education policies attempting to meet the expectations of a broad spectrum of the community. The consequences for education have been similar across the globe. Carvalho (2014b) argues that the governing of education is now largely dependent upon public policy instruments, (i.e., OECD's PISA) that produce data that "carry values, worldviews, interpretations and political aspirations to coordinate and control education" (Williamson, 2016, p. 125). In this respect:

> Analysing recent origins of data use in education requires considering the processes that connect diverse social worlds in the production and use of cognitive and normative frames about education and the ways it should be governed and that guarantee the indispensability of <*substitute any national testing program*> as a "ideational authority" (Carvalho, 2014b, p. 60).

These policy instruments (data such as international/national assessments, quality criteria and comparative benchmarks) which include both technical components and social components, inform education reform at a federal, state and local level (Croll, Abbott, Broadfoot, Osborn, & Pollard, 1994; Williamson, 2016). It is how they interact to "organise social relations between the administrative and administered subjects" (Carvalho, 2014b, p. 59), that is becoming increasingly critical in educational governance.

Grappling with the potential interconnectedness of these structural and cultural conditions promised a level of complexity that requires examination across multiple contexts, where 'data politics' are "concerned with not only political struggles around data collection and its deployments, but how data is generative of new forms of power relations and politics at different and interconnected scales" (Ruppert, Isin, & Bigo, 2017, p. 2). The interplay between the technical components (i.e., the calculations, the software, the code, the algorithms and architectures) and the social components (i.e., values, interpretations, the representations of education etc.) re-presents

complex epistemological and ontological questions asked previously about the nature of data, what we can know from data and what data really are (Williamson, 2016). Accordingly, new ways of data in education are framed within the concept 'datafication' in order to make sense of this increasingly complex space.

Datafication can simply be "ways of seeing , understanding, and engaging with the world through digital data" (Williamson, 2018, p. 1). A layer of further complexity is that "Datafication provides the lens for that consideration as, within the 'ether', it is increasingly being used to characterise the reliance of enterprises on data (and their data infrastructures), the democratisation of data and, of focus here, the process of turning that data into something of value" (Lycett, 2013, p. 381). To Mayer-Schoenberger and Cukier (2013), datafication "is the transformation of social action into online quantified data, thus allowing for real-time tracking and predictive analysis" (Van Dijck, 2014, p. 198).

Accordingly, taking a broader view of data requires thinking about the pervasive and persuasive ways data have infiltrated the systems and modes that society and particularly, education operates. Ruppert et al. (2017) argues that we need to interrogate "reasons data has become such an object of power and to be able intervene in its deployment as an object of knowledge" (p. 1). In order to do this, data, in all its forms, needs to be better understood and be made more familiar to broader society. Part of the problem is that while data is very visible and seen to make the work of schools knowable, much of the work that is done with and to data is hidden (Hardy, 2015b; Hardy & Lewis, 2016; Heffernan, 2016). While there is "an assumption that the patterns and knowledge contained within data can produce meaningful, objective and insightful knowledge about complex phenomena" (such as schools), a converse view is that data is not neutral, not impartial and consequently, should be questioned rather than accepted at face-value (Williamson, 2018, p. 9).

Seeking understanding of the rise of data use, Van Dijck (2014) argues that "Part of the explanation may be found in the gradual normalization of datafication as a new paradigm in science and society" (p. 198); for example, where education policy contends that more and better use of data will resolve much of what troubles education. It is proposed then that focussing on data as a mechanism for 'knowing' schools and consequently conditioning the action of agents forms part of the research framework. Within this analytic history of emergence, the possible causal powers of datafication are traced in order to delineate outcomes in each context.

Still focused on an infrastructural setting, the next section situates the rise of data use within the complex Australian educational policyscape constituted by conflicting state and federal educational ambitions and reforms. It is from this perspective that I reiterate Archer's understanding

that structural and cultural conditioning are matters of mediation and relational understanding in this first phase of the morphogenetic cycle.

5.3.3   National education goals 1980s–1990s

There has been a long history of global economic concerns (Ravitch, 2011) merging with fears of declining educational standards (Lingard et al., 2014). These fears in turn are utilised to rationalise and indeed galvanise educational reform across nation states in the West. A policy statement titled *Strengthening Australia's Schools: A consideration of the Focus and Content of Australia's Schools* released in 1988, by the then Australian Commonwealth Minister for Education, John Dawkins, exemplified these concerns and contended significant educational reform was necessary for Australia to ensure a stronger economic future. "The rationale for its development was the need for the Commonwealth to have a greater say in schooling policy, given its reframing as a component of economic policy, and given the responsibility of the commonwealth to manage the economy" (Lingard, O'Brien, & Knight, 1993, p. 231). Fundamental to this was that states should become more responsive, through improved curriculum and assessment policies, to the changing nature of the Australian economy and society (Lingard et al., 1993). The report hinged on the inconsistencies of performance across the states and foreshadowed a greater federal government involvement in education (Savage & O'Connor, 2015).

Traditionally (and constitutionally) the provision of costly education services was the precinct of the states; however, the perceived race to remain educationally, and thus, economically competitive was the catalyst for the Federal government's early attempts to look for commonalities in and greater control of the curriculum/education across the states. Ongoing, yet largely futile attempts were made throughout the 1990s to find and develop a common educational framework. An initial example was the development of eight Key Learning Areas (KLA) and the National Statements and Profiles for all KLAs were finalised by 1993; however, the wholesale adoption of the framework was resisted and eventually rejected by the state and territorial governments (Savage & O'Connor, 2015).

These early attempts at a national education system floundered on what Archer identifies as the "vested interests" of the states in maintaining their particular 'position' and is implicated in the potential for social processes of the unequal distribution of resources. Ultimately, she argues, "vested interests are concerned with relative advantages rather than absolute well-being" (1995, p. 204). So, while there were some benefits to adopting a federal approach to educational reform, including improved funding arrangements and curriculum alignment, the objective "opportunity costs" continued to exert an historical structural (and cultural) influence that conditioned the states

to act in a way that ensured reproduction of independent state education systems rather than transformation to a more standardised national system. This next section examines the timeframe until the inception of the National Assessment Plan- Literacy and Numeracy (NAPLAN) in 2008.

5.3.4   Renewed drive for national reform in the 21st century

From the late 1990s, increasing pressure by the federal government was brought to bear on the relative independence of the state education systems. Between 2003 and 2007 a "coercive federalism" (Reid, 2009, p.3) was evident in the relationship between state and federal governments, whereby state and territories were subject to increasing demands to align with federal policy. No longer was the 'carrot' in evidence and the Federal Liberal Education minister of the time used the threat of funding withdrawals to ensure compliance on a number of disparate initiatives: benchmark testing for literacy and numeracy, "all schools to have a functioning flag pole, A-E reporting[13], performance pay for teachers and compulsory Australian history in years 9 and 10" (Reid, 2009, p.3).

The structural influences in the form of the federal government's policy reform for schools was evidence of the increasing incongruence between state and Commonwealth interests and was representative of the "systemic fault line running through the social structure" (Archer, 1995, p. 215). The lack of complementarities between the situational logics which predispose agents (in this case, state governments) towards specific courses of action to promote their own interests, was created by interactions between, and within the emerging relationships (Archer, 1995). Ultimately in this conditioning phase, there were always good reasons (strategic guidance) provided for the states to follow particular courses of action, (these were in the form of premiums and penalties). There were also reasons they (the states) might not.

Subsequently, the federal government ensured state submission by tying funding arrangements to compliance with the educational reform agenda. There was an increasingly hostile response from across the states and territories towards the federal government's assertive presence in Australian schooling—what Archer (1995) characterises as a "defensive" mode of interaction— as the causal powers of the various emergent relations impacted on the structural and cultural domains of the state school educational systems. As Reid (2009) argues there "was growing resentment to coercive federalism from the states and the education profession who were becoming tired of the tactic of denigration of schools and teachers by Federal Education Ministers that seemed to accompany each new initiative" (p. 3). A change of government at the close of 2007 heralded a

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[13] Student achievement using a five-point scale (A–E or equivalent).

new approach to the disconnect between Commonwealth aspirations for a federated approach to schooling and individual states' desire to hold onto their constitutionally guaranteed right to autonomy. The next section charts the progress of this new policy intervention, broadly designed for improving the quality of education in Australian schools.

5.3.5 An education revolution

In 2007, the newly elected Federal Labor government announced the 'Education Revolution' arguing that Australia needed to "build a culture of high expectations in our schools for students and teachers. This culture must also be matched to effective transparency and accountability mechanisms that meet the needs of parents, policy makers and the broader community" (Rudd & Gillard, 2008, p. 5). The government aimed to improve the quality of education delivered in Australian schools in three key areas[14]:

1. Improving the Quality of Teaching: recruiting the highest performing graduates into teaching; recognising and rewarding top teachers.
2. Measuring School Performance: collecting and making available to parents in a clear and simple format, information about the performance of their child, and their child's school; public reporting by schools of their performance on key measures including national test results.
3. Helping Disadvantaged School Communities: using national data to target funding to underachieving schools; funding targeted strategies to lift performance by attracting higher performing teachers; funding intensive learning activities; engaging parents; and developing extended learning hours and services.(Rudd & Gillard, 2008, p. 5)

It signalled a significant shift in Australian education policy and practice and it was to be accompanied by a new era of cooperation across the state/territory, federal government divide (Reid, 2009). The idea of the Federal Government as a co-partner in educational reform (Savage & O'Connor, 2015) was developed through the creation of a number of key organisations with federal government influence embedded into the governance structure.

Two organisations personified this combination of policy governance and political aspiration. The Australian Curriculum Assessment and Reporting Authority (ACARA) was (and is) unique in structure, owned and funded by all nine governments and created by an Act of Parliament which included agreements of its structure from both state and federal governments (Savage, 2016;

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[14] I've included the aims of the Education Revolution because in some ways these goals still largely inform educational policy in an Australian context (more or less).

Savage & O'Connor, 2015). It endorsed the same spirit of interstate organisation and cooperation that the second of these organisations, the Council of Australia Governments (COAG), the peak intergovernmental forum in Australia, continues to seek. However, it remains revealing that the Prime Minister is the chair of COAG and that according to its website, "Raising productivity is a key focus of COAG's agenda, and education and training are critical to increasing the productivity of individual workers and the economy" (COAG, 2014, p. 1).

Despite a focus on Commonwealth politics that powerful organisations such as ACARA and COAG brought to the governance arena (Savage, 2016) there were also other agents (see Chapter 3) at work. In reaction to the perceived risk of Commonwealth politics overwhelming the states' role, the Council of the Australian Federation (CAF) (Twomey & Withers, 2007) represented a "structural response to ongoing state concerns about the trend to an increasingly centralised pattern of Commonwealth-state relations" (Tiernan, 2008, p.22). The function of CAF was to act as a mechanism for aligning approaches and dialogues with the Commonwealth, and to operate as a negotiating space for policy ideas, matching regulatory frameworks and improving service delivery in areas of state responsibility (Tiernan, 2008). From an Archerian perspective, these organisations as second-order structural and cultural emergent properties with their associated causal powers and working as they do at the macro-institutional level, had the potential to affect sectors of the population (Archer, 1995). Whether they did or not was dependent on the tensions and compatibilities between the different ways they interacted at the socio-cultural level.

Post the announcement of the Education Revolution in 2007, the federal government continued to promote national competitiveness, better economic/productivity, and improved equity outcomes, through education system transformation. Several major educational reforms were implemented in the following decade (Gillard, 2008; Rudd & Smith, 2007; Savage, 2016). Three examples personify these developments. In 2008, the first iteration of nationwide standardised testing, the National Assessment Program-Literacy and Numeracy (NAPLAN) took place. This was followed quickly in early 2010, by the rollout of the much vaunted transparency and accountability tool (Lingard & Sellar, 2013), the website *MySchool* (Cash, 2010) which published and compared NAPLAN test performances of individual schools. A final reform was the development of the Australian Curriculum which was considered (and strenuously promoted as) the result of an extended consultation period designed to counter any allegations of 'steamrolling' from the states.

The emergent structural and cultural properties and powers associated with these interventions were powerful enough to force significant structural and cultural changes in the unique education policy cultures and governance systems of the individual states and territories

(Gable & Lingard, 2015; Hardy & Boyle, 2011; Lingard & Sellar, 2013; Thompson & Cook, 2012). Accordingly, it is argued that these policy instruments—national assessments (NAPLAN), quality criteria (Teaching standards) and comparative benchmarks (MySchool website and NAPLAN reporting structure)—had "engendered cultures of performativity" where actors and agents across the strata were asked to respond to "externally defined agendas" (Priestley, Biesta, & Robinson, 2015b, p. 105). While not in the same league as PISA, the combined power of nation-wide testing and the MySchool website function as a noted resource for policy, applying as they do as a set of rules for the governing of education at both a state and federal level (Carvalho, 2014b). As well, the regular annual testing regime offered an evidence-based model for the coordination and control of activities across the education sector (Carvalho, 2014b). These new ways of *knowing* through data provided both government and communities the means, and indeed a mandate, to impose further layers of accountability upon schools.

Arguably, at the time of these reforms, the states and territories appeared to engage with the changes in a spirit of cooperative federalism (Savage, 2016). However, from an Archerian perspective, with Labor governments in power in all states, necessary and internal linkages of an incompatible nature existed between the systemic structure of the state and federal parliaments. This meant that apart from some power struggles around funding and accountability regimes, the situational logic was one of compromise. Archer describes this logic of compromise as being "a cautious balancing act, a weighting of gains and losses, where to accrue bonuses is also to invite or incur penalties" (1995, p. 224).

It could be reasoned that a congruence of politics should have existed between the State and the Federal Labor governments enabling an uncomplicated enactment of policy arrangements. However, here it is argued that while the emergent relations were no doubt more complementary, there were, in fact, constraining contradictions associated with the cultural arrangements that resulted. Accordingly, the situational logic brought about by the different and sometimes conflicting state values and initiatives (Yates, Collins, & O'Connor, 2011) ensured that the ongoing cultural arrangements continued to influence educational reform at a state level.

While the states were committed to pursuing their own state educational objectives and policies, they were also confronted with a specific situational logic; in this case, access to funding and some degree of autonomy in exchange for the development and implementation of a national curriculum. The national curriculum was a policy intervention the states and territories had considered antithetical to their own needs in the past; however, now they were forced to "neither embrace it as it stood nor could they reject it out of hand" (Archer, 1988, p. 155). Instead they had

to, in the words of Archer, struggle to extract what was necessary from the federal government (funding and autonomy), all the while "warding off the counter-attractions or counter-claims and avoiding the seductive labyrinth of doubt", to return to their respective states bearing their offerings (1988, p. 155). The uncertainties surrounding the traditional roles of federal and state governments in policy direction in educational governance continued to play out in formal and informal settings[15].

The general improvement in the relations between the federal and state governments and territories educational bodies during the 2000s led to a more cooperative approach (Savage, 2016). However, there can be no doubt that the widespread changes to social structures, infrastructural and institutional systems and institutional settings over this time were a direct result of a general embrace of a neoliberalist focus, ideas and beliefs which tied "human capital arguments about the centrality of education and skills to the competitiveness and productivity of the Australian economy" (Lingard & Sellar, 2013, pp. 2-3). Driven by powerful interest groups and the emergence of accountability and improvement regimes, an audit society (Power, 1997) and the widespread access to, and focus on data and the need for transparency found favour with the Australian political class.

5.4 **Summary**

Part 1 of this chapter has described the changing nature of educational governance and policy production at an infrastructural level and the increasingly prominent place the use of data has played in setting goals, targets, performance indicators and monitoring in Australia's national and state education systems over time. The structural arrangements that emerged from a progressively more focused approach designed to ensure that the state governments aligned with the federal government's aspirations for national consistency of educational approaches on the grounds of equity, effectiveness and efficiency (Savage, 2016) have been described. The devolved and independent nature of the states' and territories' educational arrangements within the structure of Australian federalism made this a complicated endeavour.

Nevertheless, over the past four decades the federal government has had considerable success in drawing the states and territories into firstly, some powerful intergovernmental policy organisations and agreements, and secondly into taking part in multiple reform initiatives (Savage,

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[15] An Archerian perspective offers a reliable method of theorising how two different situational logics were operating in the same space—the first from a structural perspective, the second cultural. This will be explored further in the final chapter; however, I wanted to signal this advantage here.

2016). To overcome the low levels of system and social integration between the federal and state governments required a shift in both material and ideational understanding. The first was accomplished via federal funding arrangements, either through penalties (sticks) or rewards (carrots). The second was a more difficult course of action that relied on setting up both a culture of accountability and competition in a state educational race. This was realised through a public policy instrument, the standardised testing regime of NAPLAN. It was earlier argued that these data combined with associated visualisations (MySchool) has the potential power to "carry values, worldviews, interpretations and political aspirations to coordinate and control education" (Williamson, 2016, p. 125). While this might be somewhat excessive, there is little doubt that the effects of NAPLAN continued to be played out in both federal and state educational arenas.

It is proposed that "new forms of governing are connected with new ways of knowing" (Carvalho, 2014b, p. 58) is a central premise to move forward with. How these structural and cultural emergent conditions interact will be discussed in Part 2 of this chapter.

5.5 Part 2: Interaction

Part 2 of this chapter describes and analyses the social, socio-cultural and group interaction phase of the morphogenetic approach. It examines how agents work and interact with and within the structural and cultural conditions described in Part 1. While these systemic and institutional strata conditioned and shaped the organisational environment, in turn these influences were mediated by the state level emergent properties in action at that time. The prior structural and cultural conditioning shaping the institutional level of the Queensland educational context continues the understanding of "context as stratified, conditioned, relational and temporarily dynamic through the 'steps' of the contextual strata" (Herepath et al., 2015, p. 20).

5.5.1 The Queensland context

In the Australian context, the different histories, different geographies and quite different demographics in each state have influenced the education systems that have emerged (Yates et al., 2011). Queensland, particularly, had been "viewed as a tradition-bound and conservative culture and polity" (Gilbert, 2011, p. 164). This, combined with a lack of a strong educated class, rural and provincially located political power despite a centralised governance structure and a long history of predominant socially conservative views, had left successive Queensland governments with strong political imperative to make changes (Gilbert, 2011). Interestingly then, despite being labelled as politically conservative, the state has demonstrated a tendency to educational innovation in several large-scale reform developments over the years (Mills & McGregor, 2016). One example, the removal of public examinations in year 12 and the introduction of a system of school-based

assessment and moderation at the time (1972) was revolutionary and has remained a consistent centrepiece of Queensland secondary education for over 40 years[16].

Mediated by agency, the causal powers of initiatives such as the school-based assessment program contributed to structural morphogenesis and the emergence of new and different structural and institutional forms. On the other hand, a long history of conservative politics resulted in a rejection of some federal educational policy reform. As Archer explains "social action determines which logical relations shall have cultural salience in society" (1995, p. 246). Accordingly, within Queensland, a legacy of progressive educational reforms on the one hand, combined with a strong political imperative for change on the other was complicated by an 'inertia of tradition' which made for a complex mix, the outcomes of which were not predictable.

The educational policy arc (in response to higher-order influences) that had conditioned and shaped education in Queensland during the federally influenced education reforms of the early 2000s has been documented in a number of places and space precludes its inclusion here (Gilbert, 2011; Hardy, 2015a; Lingard, 2011; Lingard & McGregor, 2013; Lingard & Sellar, 2013). However, it is worth noting, that at an infrastructural level, the Queensland education sphere in the 21st century continued to be characterised by the central role of the state government in the collective production and delivery of public education. A focus on education and productivity, quality and the ability to compete with other states, and indeed nations, remained the aspiration central to any new policies and initiatives introduced in Queensland (Matters & Jones, 2013). Queensland's Department of Education's policy vision continued to be "Queenslanders have the education and skills they need to contribute to the economic and social development of Queensland" (DoE, 2018). It also ensured its education systems were aligned with the state's employment, skills and economic priorities (Isaacs, Creese, & Gonzalez, 2015). Consequently, there was an element of PISA 'shock'[17] for Queensland in the wake of the first iteration of NAPLAN (Grek, 2009; Sellar, 2014).

5.5.2 Testing times in Queensland

In 2008, the first year of NAPLAN testing, Queensland performed comparatively poorly to (most of) the rest of the Australian states. Media coverage and public opinion ensured an immediate

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[16] The Year 11 cohort of 2019 takes part in a new assessment program in line with other states which includes an external examination and the awarding of an ATAR (Australian Tertiary Admission Rank).

[17] The first PISA results released in 2001 caused a reaction in Germany that is now referred to as 'PISA-shock'. The perceived poor performance of Germany in the first round of PISA resulted in major changes in education policy across the country (Grek, 2009).

response from the state government of the time (Lingard & Sellar, 2013; QSA, 2008). The Australian Council of Educational Research (ACER) was appointed to review the literacy, numeracy and science performance of Queensland primary school students. The subsequent final report, *A Shared Challenge: Improving Literacy, Numeracy and Science Learning in Queensland Primary Schools* (hereafter, the Masters' report) was released in April 2009 (Masters, 2009). Aside from some 'quick fix' tactics in order to improve Queensland's NAPLAN performance in the short term, the review also recommended some long-term changes in education policy and governance (Lingard & Sellar, 2013).

The Teaching and Learning Audit process and the introduction of teaching standards were just two of a series of school improvement policy reforms that the Queensland government implemented in the years following the perceived poor performance in NAPLAN. The reforms, informed by the Masters' Report, international research on effective practices for continuous improvement, and a Systems Review undertaken by Fullan and Levin that evaluated the school improvement agenda implemented across the Queensland education system (Fullan & Levin, 2011) had significant effects on state schools.

One of the most notable reforms was the implementation of Teaching and Learning Audits (Masters, 2010) in all state schools. ACER developed the audit framework in consultation with Education Queensland in a flow-on result of the Masters' report. The audit tool required schools to be prepared for a judgement or rating to be made based on the observations of a trained school auditor (an experienced principal) for each of eight interrelated domains. The domains were:

1. An Explicit Improvement Agenda
2. Analysis and Discussion of Data
3. A Culture that Promotes Learning
4. Targeted use of School Resources
5. An Expert Teaching Team
6. Systematic Curriculum Delivery
7. Differentiated Classroom Learning
8. Effective Teaching Practices

Each domain identified an aspect of a school's day-to-day operating practices (Masters, 2010). A school's practices were rated as 'Low', 'Medium', 'High' or 'Outstanding' according to the level the auditor judged the school to be (Masters, 2010). The first cycle of audits was carried out in 2009 and by the end of 2010, all state schools in Queensland had experienced the audit process. Following the audits, State schools were required to develop a School Plan within a four-

year planning cycle, one that defined improvement priorities, strategies and goals, set targets and used performance measures in the pursuit of educational excellence for all students (Education Queensland, 2013). The Teaching and Learning Audits were embedded in a quadrennial planning cycle and were considered an essential part of the school improvement and accountability framework for Queensland State schools.

The audit process was readily accepted by school principals at the time as it provided a workable school improvement framework (Campling, 2012; Mills et al., 2012). However, this shifted quickly once Education Queensland (EQ) in response to public pressure and the freedom of information act, and despite assurances it would not do so, released the audit results to the media in January, 2012 (Chilcott, 2012a; Lingard & Sellar, 2013). The main city newspaper created a league table which identified schools where good teaching was taking place, and supposedly where it was not (Chilcott, 2012b). This led to a strong protest by teachers; the Queensland Teachers Union (QTU) response was immediate and all union members were directed to stop participation in the audit process. Notably, the paper argued that in the interest of accountability and transparency that parents had a right to know the apparent quality of their schools (Chilcott, 2012a). The audit process was suspended for the duration until EQ and the union came to an agreement which entailed the restructure of the audit process and an understanding of how the data was disseminated to the public (QTU, 2012).

An Archerian understanding supports an emergent analysis of these circumstances where each hierarchical level has its own peculiar mechanisms and emergent powers (Collier, 1994). In these circumstances, the Teaching and Learning Audit functioned as a structural emergent property designed to bring about school improvement. However, a theoretically competing cultural emergent property, accountability, had the potential to enable or constrain social agent action on different levels, the results in this case being unforeseen and destabilising. The public release of data that intentionally or unintentionally reshaped power relations between schools and their communities acted as a mechanism of managerial control (Coburn & Turner, 2011b). Accordingly, the effects of the audits and their associated evidence collection processes on schools were examined more closely to determine impact on individual school practices.

5.5.3 Summary

The interaction phase delineated above indicates the possibility of both morphostatic and morphogenetic conditions operating in the same cycle. The nature of the Queensland educational system which housed pockets of curricula and pedagogical innovation alongside a generally conservative government approach to educational growth can be explained by the corporate re-

grouping of agency in one section. The growth of agency in the teaching profession that supported the structural and cultural arrangements which translated into the curricula and assessment freedom present in the secondary schools for such a length of time is considered unusual, in a sector known for change. However, with the growing intervention of the federal government in state politics, much of the support for this innovation had been withdrawn. The policy adjustments and the impact of performative cultures shifted the Queensland education focus to a more data-informed school improvement agenda and more overt accountability processes. The new processes associated with these policy initiatives were specifically designed to shape leaders and leadership practices going forward (Heffernan, 2016).

5.6   Part 3: Outcome of interaction

Part 3 evaluates what the product of interaction had been in terms of structural, cultural and group reproduction or change in the infrastructural and institutional settings. It considers the outcome of the social and systemic alignments and contradictions between the federal/state governments at $T^1$and the interaction with the Queensland education system between T^2 and T^3 (see Figure 5.2). It outlines the likely causal properties and the structural and cultural conditioning in evidence at T^4 expected to influence case schools at both a relational and individual level. Here the research draws closer to the empirical data in order to confirm the effects of influential structures. In doing so, it establishes T^1 of the next morphogenetic cycle and the context for further analysis in Chapter 6 and 7.

5.6.1   The emergence of new modes of school improvement practices

The implementation of the Teaching and Learning Audits signalled a commitment by the Queensland government to improve educational outcomes in schools. The design of the tool was "based on international and local research into effective school improvement practices, the findings of *A shared challenge: Improving literacy, numeracy and science learning in Queensland primary schools* (Masters, 2009), and a Roadmap for P–10 curriculum, teaching, assessment and reporting" developed by the Department of Education and Training (Matters & Jones, 2013, p.iv).

The audit tool focused on a set of school standards that included descriptions of high performance whole school and teaching practices designed to improve the quality of teaching and learning in the classroom (Masters, 2012). Because the audit and the subsequent school review process were influenced by previous education structures (the Master's report and roadmap) and the perceived needs of the community (NAPLAN improvement), they are seen as structural emergent properties, new features or transformations with new characteristics that differed qualitatively from the elements they came from (Herepath et al., 2015).
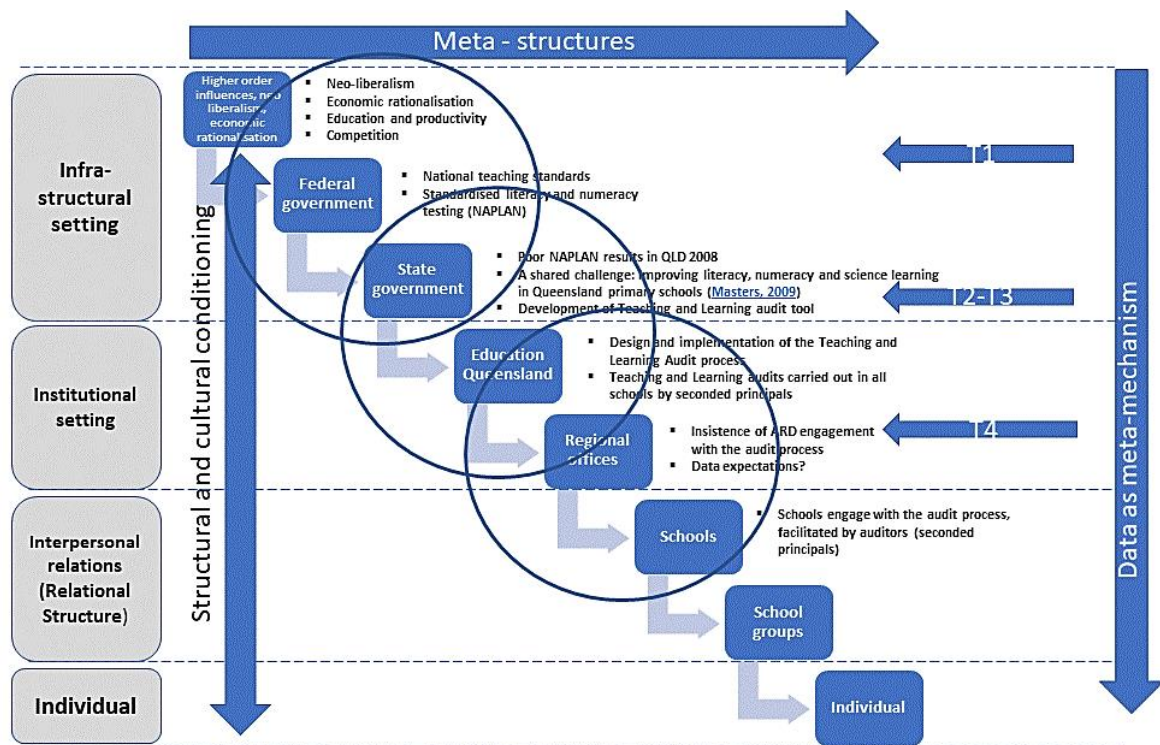
Figure 5.3: Context strata institutional/relational setting interaction (adapted from Herepath et al., 2015)

Each are transformations that are influenced by the circumstances in which they occurred; however, they cannot be returned to their previous form. Emergent from this focus was increased attention directed at data from NAPLAN testing and other standardised measures as evidence of quality outcomes (Gable & Lingard, 2015; Hardy, 2015b; Lingard & Sellar, 2013). Consequently, there was now "a constant pressure at the school level to produce, analyse and act upon the data" as a means to improving student outcomes (Lawn, 2013a, p. 9).

Central to this school improvement and accountability agenda, and the focus on data, was an emphasis on the work of teachers and school leaders (Masters, 2012). "Teachers have the ability to transform the lives of students and to inspire and nurture their development. School leaders have the critical role to play in supporting and fostering quality teaching, and in creating safe and orderly school environments" (Matters & Jones, 2013, p. 1). Consequently, an identifiable focal point of the school improvement agenda that remained was/is 'good teaching'. In this constant conjunction view, if 'good teaching' is happening in the classroom, then naturally school improvement will follow. The development of evidence-based measures and practices of this 'good teaching' became a priority for the state government, the findings and analysis of which were appropriated to inform educational policy and were used to 'raise standards' across the sector.

In considering how good educational outcomes might be assured (how 'good teaching' might be enacted), Masters (2010, 2012) suggested that two sets of standards, working in tandem might produce the required results:

1. Standards of professional practice, as in those evidence-based guidelines that are expected of all practitioners. In Australia, these have been developed by the Australian Institute for Teaching and School Leadership (AITSL, 2011).

2. "Standards of school performance, descriptions of highly effective whole school practices and clear guidance on what schools can do to improve the quality of classroom teaching and learning" (Masters, 2012, p. 1)

To place these standards in context, the first, the Australian *National Professional Standards for Teachers* is a public statement of what constitutes quality teaching (AITSL, 2011). The standards were developed in 2011 as part of federal educational reform (National Partnership on Improving Teacher Quality) and were designed to replace the various competencies and standards active at the state level (Santoro, Reid, Mayer, & Singh, 2012). The second of these standards was one of the rationales for the development of the Teaching and Learning Audit Tool, the precursor of the National School Improvement Tool (used in the School Review process). Accordingly, the outcome of these educational reforms made principals and teachers subject to "new externally introduced discourses" that often contested the locally recognised way of doing things (Priestley et al., 2015b, p. 106). There now existed new technologies and new means to surveil and monitor teachers' work. These new structural and cultural emergent properties created situational logics that continued to condition teachers' work.

Preliminary abstractions and analysis confirmed the influential nature of the Teaching and Learning Audits carried out between 2010 and 2014 in state schools in Queensland. Figure 5.2 depicts the implementation of the audit process and the interaction between the relational setting and the institutional setting in the education field. Table 5.1 summarises previous Teaching and Learning Audit outcomes for all case schools. The individual ratings for each domain provide insight into both the drivers of the school improvement plan and the motivations of the leadership team in the years following the implementation of the first audits in 2010.

The generative powers emergent from the audit process (particularly low/medium ratings) impacted in significant, and sometimes subtle ways on the relationships at different levels, as the agents of schools and educational regions developed different strategies/actions to promote their own individual/ group interests. To expand on this, the audit process is described as a structural emergent property, a structural condition, generated by Education Queensland's need to implement

a systemic wide school improvement initiative that provided both direction and accountability in schools. As an emergent property it is then destined to interact with other emergent properties identified in the next sections. The relations between and within these emergent properties are then responsible for creating the "quite distinctive *situational logics* which predispose agents towards *specific courses of action* for the promotion of their interests" (Archer, 1995, p. 216). In other words, the audit process provided strategic guidance about what to do, by providing good reasons (premiums and penalties) for schools for taking (or not taking) alternative forms of action.

Table 5.1: 2011/2012/2014 Teaching and learning audit results [18]

School	Improvement Agenda	Data Analysis	Learning Culture	Targeted Resources	Teaching Team	Curriculum Delivery	Different-iated Learning	Effective Teaching
Brushbox (2011)	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium
Brushbox (2012)	Medium	Medium	High	Medium	Medium	Medium	High	Medium
Corymbia (2011)	Medium	Medium	Out-standing	High	High	High	Medium	High
Corymbia (2013)	High	High	Out standing	High	High	High	High	High
Botanica (2011)	Medium	Medium	High	Medium	Medium	Low	Medium	Medium
Botanica (2014)	High-Out-standing	High-Out-standing	High	High	High	High	High	High
Waterhousia (2011)	Medium	Medium	High	High	Low	Medium	Medium	Medium
Waterhousia (2014)	High	High	High	High	High	High	High	High

Data were assembled from the original 2011 Teaching and Learning Audits published in *the Courier Mail* under the masthead of *The Australian* http://www.theaustralian.com.au/news/report-card-how-your-school-stacks-up/story-e6frg6n6-1226255868681 28/01/2012 (Chilcott, 2012b). Results from subsequent Teaching and Learning Audits were developed from a document review of school websites.

One principal described her response to the process:

> We just had an audit last year…so when I came in, I think we had an audit in May which was great for me…great baseline data for me also recognition of where we were travelling and what issues I needed to address immediately. So, the auditors looked at what I had just started since I came in so that was really good for me.

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[18] Teaching and Learning Audits were carried out every four years as part of a quadrennial improvement cycle. Audits were also carried out post the appointment of a new principal or in other special circumstances. For example, Brushbox had a new principal in 2012.

We're not due for anything soon unless our data goes really badly wrong and we get all red… (BlSSPr)

Consequently, the audit as an emergent property was fundamental to what happened in each school as the mechanisms associated with the process were experienced on a day-to-day level. They were, however, not the only mechanisms activated in each context and this recognition is inherent in the DNA of the morphogenetic approach. It is how these systemic properties are related to, and interact with each other, that provides greater insight into how each context is shaped for the agents involved (Archer, 1995).

5.6.2 The rise of leadership as structural conditioning

Consistent with the targeted improvement agenda, Education Queensland implemented numerous policy initiatives in 2015, which placed the onus of school improvement on principals and their individual leadership practices. The School Improvement Unit (SIU) was launched as a separate organisation from the delivery arm of state schools reporting directly to the Director General. An updated school review process[19] which differentiated school performance by means of a regular system-generated 'school performance' data profile which includes data sets of NAPLAN, school-based assessment data, and disciplinary, attendance, and retention data, as well as demographic and enrolment data was implemented (Heffernan, 2016). Bloxham, Ehrich, and Iyer (2014) argue that this data-heavy representation of schools was closely aligned with the department's improvement agenda at that time, and subsequently it served as the focal point for target-setting discussions between Assistant Regional Directors-School Performance (ARDs-SP)[20] and principals. Used as a means of "identifying and matching support to the needs of schools" (Department of Education, 2015, p. 3), the system's emphasis on data also served as a means to surveil schools, and in turn, principal performance (Bloxham et al., 2014). In essence, the data profile appeared to establish a new way of 'knowing' schools.

In conjunction, a series of models[21] supporting principal capability development were devised, including professional development courses, online, face-to-face coaching and mentoring.

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[19] The school review process replaced the teaching and learning audits. The process was similar but with the addition of Domain 9 which focused on community relationships.

[20] In 2010, the position of Assistant Regional Directors, School Performance (ARD-SP), was established to positively impact upon student learning across public schools in Queensland, Australia adding an extra layer of management. Principals reported directly to regional ARD-SP.

[21] There was a series of reports and documents informing leadership development in Queensland over the years. These were summarised in a book chapter entitled "When research policy and practice disconnect: An educational leadership policy example" by Farwell (2016) which detailed the policy overlay that occurred as each new government applied *new* policies and strategies in response to the demand for better education systems and school outcomes.

These focused initiatives were determined by the individual needs of the principal, in consultation with their ARD-SP. A suite of multi-layered strategies was utilised which included: coaching and mentoring colleagues across schools, clusters, networks and regions, observation opportunities, learning from other principals on the job, coaching activities, professional development opportunities, and study tours (Education Queensland, 2011). The outcome of these extensive professional learning opportunities was the expectation that principals would identify specific data benchmarks for improvement and design, and implement and monitor a whole-school explicit strategic improvement agenda to achieve them (Education Queensland, 2011).

Consistent with these initiatives was the policy focus on data-driven decision making and the collection of the *right* data by principals to support good decision making across the school level, the regional level and the Queensland-wide level (Education Queensland, 2011). A corollary to this was the explicit recognition that data work should be focused on improving learning outcomes and the implicit understanding that progress in this area was to be monitored "through domain two—analysis and discussion of data—of the Teaching and Learning Audit outcomes" (Education Queensland, 2011, p. 9). Accordingly, data-driven target-setting and decision making retained central roles in leadership frameworks and any emergent systemic policies and procedures.

5.6.3 The rise of accountability as a cultural condition

These recent policy reforms were driven by a strategic agenda that focused intensely on discourses of school improvement and accountability (Heffernan, 2018) with a singular aim of improved data on everything from NAPLAN scores through to school attendance. Accordingly, Queensland schools were not only dealing with the implementation of widespread federal reforms in the shape of MySchool and the Australian curriculum, they were also faced locally with the external audit process and a succession of policy updates from consecutive governments (Heffernan, 2018). Regional Directors and newly recreated ARDs-SP were also charged with new powers that focused on "tracking performance, sharing quality practices and ensuring that the goals for improvement were realised across the state" (Education Queensland, 2011, p. 3) in this increasingly accountable environment (Bloxham et al., 2014). Primarily, the pressure for these school improvement initiatives fell on the principal, with a concurrent rise in a sense of accountability brought on by the increased focus on delivering an explicit school improvement agenda. However, school improvement measures were also felt in the classroom with newly funded Master Teacher and data specialist roles providing focused support for targeting instructional teaching. These policy reforms which pressured for immediate improvement in data, along with a

more sustained focus on long-term student impact, appeared to engender a sense of urgency in schools (Heffernan, 2018).

5.6.4   New data use as a structural condition

A new focus on school improvement and accountability directed principals towards short-term gains by improving measurable data such as attendance, exclusions and discipline data along with NAPLAN data (Heffernan, 2018). Furthermore, with the establishment of the ARD-SP position, there was a definite shift away from the support, development and growth of principals and a "strong(er) focus on accountability, performance and outcomes" (Bloxham et al., 2014, p. 34) the measurement of which was derived from collected school data. How principals responded to these policy shifts is described and analysed in Chapter 6 and 7. However, early indications suggested that data use was shifting the way different groups interacted with each other and the power structures present. Following is an excerpt from a conversation with the principal of one of the small rural schools:

> KS: Is there pressure associated with those regional benchmarks?
>
> BrSSPr: Pressure with those regional benchmarks? Yes! And why are we not meeting them?
>
> KS: Is that a conversation that you have with your people or other people have with you?
>
> BrSSPr: Yes… from higher up people too…how are you improving data in your schools? Even higher up so I'm talking regional director and that comes down to the assistant regional directors and then comes into the schools and when we go to regional business meetings which are once a term. They are normally in Tallowwood[22] and there is always a discussion around data and how to improve our data. I think the last one was on attendance.

In this respect, the use of data has implications for the way it enables and constrains what people think they need or are required to do. It is within this shaping of opportunities that as Selwyn (2014) argues lies the operation and influence of power. Accordingly, new modes of data use may appear to intensify the social relations between different education groups and indeed may make power structures in place even less transparent, less visible. Data use emerges as a structural condition likely influential in the next phase of the morphogenetic cycle, supplying reasons as to why teachers responded as they did.

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[22] Regional city

5.7   An Archerian summary

Part 3 has delineated the final sequence of this morphogenetic cycle of which the end-product is structural elaboration in the form of the various policy reforms (and their subsequent consolidation) the Queensland government put in place following the poor performance of schools in the first iteration of NAPLAN in 2008. Concurrently, structural and cultural elaboration had occurred in the form of increased systematised management practices focused on both school improvement and increased accountability of schools. This mixture exacerbated by the datafication of education had generated a sense of urgency around school reform. A focus on the ideational mix of the neoliberal ideal of economic productivity aligned with educational outcomes and the school role in this established the complexity of this space. Yates (2013) argues that:

> Schooling in industrial and post-industrial societies has long had a dual function: to teach or develop young people in particular ways, and to select and sort them. In the 21st century, both agendas have become a genuine problem for governments and for curriculum authorities: the first because of the 'changing world' and real questions about what knowledge and foundations look like today and the second because of new global drivers and a new political and public rhetoric about what schools can do.
>
> (p. 39)

The contradiction between these belief systems is a practical problem for those who produce policy, those who enact it, and those who must live with it.

The emergent structures from these intricate social interactions formed a tangled web which resulted in both school improvement and accountability discourses woven into school-based interactions. The general managerialist approach of the federal and state education systems is likely to complicate the day-to-day performance of school life. The result, that "Most commonly the work of teachers occurs within competing policy contexts of which they have no control" (Mills & McGregor, 2016, p. 123). This work was further intensified by the emergence of datafication. Accordingly, these new ways of 'knowing' schools were now very likely the most powerful and related phenomena shaping educational work at the level of policymakers, administrators, principals, and teachers in schools (Sellar, 2017; Selwyn, 2015; Williamson, 2016).

The analytic history of emergence presented here revealed several probable structural and cultural emergent conditions relating to school improvement present at T^4 of MM cycle 1 (which becomes T^1 in the next cycle) likely to influence teacher and principal interactions in each school

case. While they were not the only conditions emergent, their prevalence at Queensland policy and government levels ensured that they would be causally effective. They were:

- leadership capacity, performance and development
- data use
- school improvement agenda and initiatives
- accountability.

These broad conditions were tentatively established earlier in this chapter, yet they did not hold any clear guidance as to how schools might negotiate these new conditions at the relational and individual level.

The answer to this methodological dilemma rested in the morphogenetic approach. Archer argued that it is can be considered a sequencing issue, describing it as "a methodological procedure deriving from analytical dualism, which directs us to look at *how* the (structural) and cultural context is shaped for agents *before* examining what they do in it or what they can do about it" (1995, p. 245). Understanding how the world that agents enter each day has been structurally and culturally conditioned by a set of prior interactions is a pre-condition to understanding agent action and interaction. Accordingly, the analysis returned to the agents and how, through their ideas, resources, alliances and power, they were able to transform or reproduce the context. The Socio-Cultural Interaction phase explained "how relations between people change or maintain the relations between ideas, and also change or maintain the relations between material structures" (Archer, 1995, p. 246). Here, analysing the previously articulated zone of interaction (Wallace & Priestley, 2011, p. 362) likely to occur around new uses of data now relied on building a stratified concept of principal/teacher agency.

5.7.1 Emerging structural and cultural conditions

Archer (1995, 2000) conceives agential interactions are analytically distinguishable by the various positions, resources, ideas and knowledge that agents involved possess (Case, 2013). This stratified understanding of teacher and principal agents proposes it is a matter of mediation and exchange of power (possible generative mechanisms) between agents and emergent properties and their probable reproduction and/or elaboration that concentrates the attention. Distinct powers and mechanisms belong in different strata of reality, yet their individual or combined effect may not be limited to one layer, and consequently, some agents (principals) have the power to interact across the strata. In this respect:

(Agents) are responsible for mediating between the two strata, since the bargaining power lodged in the first distribution of resources has to be converted into negotiating strength of one set of agents in relation to others for any specific emergent property to change or remain the same.

(Archer, 1995, p. 326)

Table 5.2: Analytical dualism in social theory, a stratified version of agency (from Archer, 1995, p. 190)

SYSTEM INTEGRATION Distinctive emergent properties (SEPs and CEPs school improvement, leadership, accountability, data use)			SOCIAL INTEGRATION Different PEPs, Human beings, actors and agents, teachers and principals	
Systemic	------------------	Interplay	------------------	Populations
Institutional	------------------	Interplay	------------------	Organised groups (corporate agency)
Roles-Leadership	------------------	Interplay	------------------	Individual actors-Principals
Positions	------------------	Interplay	------------------	Collectivities (primary agency) Teachers

Table 5.2 outlines the basis for this understanding of the interplay between system and social integration which exemplifies a stratified view of agency. In this rather long quote, Archer explains the transformation of agency, whereby primary agents have the potential to transform and corporate agency is a possible outcome of the double morphogenesis:

Although separable because phased across different sequential tracts of time, they are intertwined in the 'double morphogenesis' where agency undergoes transformation, acquiring new emergent powers in the very process of seeking to reproduce and transform structures. For in such structural and cultural struggles, consciousness is raised, as Collectivities are transformed from primary agents into promotive interest groups; social selves are re-constituted, as actors personify roles in particular ways to further their self-defined ends; and corporate agency is re-defined as institutional interests promote reorganization of goals in the course of strategic action for their promotion or defence.

(Archer, 1995, pp. 190-191)

In other words, within the position-practice systems of principals, they as agents might have sufficient leadership power to mediate the structural and cultural conditions emergent from the previous morphogenetic cycle.

Yet the positioning of principals as agents of change brings its own dilemmas. Principals are situated at the interface between the different cultural and structural conditions and their leadership is an essential component of school improvement. Influential transnational publications from the OECD support this focus on leadership, "As the key intermediary between the classroom, the individual school and the education system as a whole, effective school leadership is essential to improve the efficiency and equity of schooling" (Pont, Nusche, & Moorman, 2008, p. 16). Accordingly, the capacity of principals to shape and lead change relies on both their skills and motivation and their understanding of the conditions in which the interplay between policy (structure), teachers (agency) and accountability (culture) takes place.

While there is a degree of autonomy in the discourse surrounding school leadership, this is also aligned with a corporate managerialist approach where centralised systems place external accountabilities and data targets upon schools. Principals, therefore, must be able to negotiate the dual emergent properties of an 'autonomous' school improvement agenda and externally imposed accountabilities. The implication is a context where principals might be empowered on the one hand and disempowered on the other.

> Many countries have made schools more autonomous in their decision making while centralising standards and accountability requirements and demanding that schools adopt new research-based approaches to teaching and learning. In line with these changes, the roles and responsibilities of school leaders have expanded and intensified. Given the increased autonomy and accountability of schools, leadership at the school level is more important than ever.
>
> (Pont et al., 2008, p. 16)

Therefore, principal agency is likely to be an emergent phenomenon that is dependent on both structural and cultural interplay with the individual (Priestley, Biesta, & Robinson, 2015a). Within a stratified understanding, principal agency is then positioned as central to how schools and the teachers within negotiate school improvement policies and the new data accountabilities that come with them. Leadership and leaders are seen as 'bridging' the gap between data and the teachers (Earl & Katz, 2006; Earl & Timperley, 2008; Sharratt & Fullan, 2012). How teachers negotiate new data uses is likely to be dependent on the power each principal holds to influence the

context and the emergent social relations, in which the teachers work with data. Consequently, the second stage of analysis (Chapter 6 and 7) focused on how principals and teachers as agents worked within the emergent structural and cultural conditioning in order to identify the generative mechanisms enabling or constraining the development of data use in each case setting (Gable, 2011).

5.8   **Summary**

This stage of analysis confirmed the structural and cultural properties emergent from a prior morphogenetic cycle influencing data use at the individual teacher level. This comprised a document analysis and the refinement of a historically specific understanding in an analytic history of the emergence of the research phenomenon. This analysis was supported by "'analytical dualism', a methodology based upon the *historicity of emergence"* (Archer, 1995, p. 66), which analyses the interaction between structure, culture and agential action over time and always in the context of additional causal factors and mechanisms (Elder-Vass, 2007).

The analysis outcome was the identification of four high-level structural and cultural properties emergent from the infrastructural and institutional strata likely to influence data use at the relational and individual level. While these conditions were clearly important, their meta-structure status was not sufficiently nuanced to determine the causal mechanisms likely to influence data use in schools. This methodological challenge was met through a return to Stage 4 and 5 of the explanatory model in order to make the connection across the strata.

The literature indicated the importance of leadership and effective school leaders to provide a bridge between schools and external school improvement policies and strategies. Accordingly, it was proposed that the initial socio-cultural interaction between these structural and cultural emergent conditions and agents (principals) with enough position-practice power to negotiate (mediate), was likely to be causally effective. The question to be answered now was how the teachers in the four case schools, two small, rural and two large, urban mediated the contradictions and pressures that were embodied in the next conditioning cycles (Willmott, 2002).

Taking into account this new understanding resulted in the identification of four emergent structures likely to be causally effective in the structural arrangements in each case. Consequently, this analysis was able to answer the initial research question posed at the beginning of the chapter concerning the pre-existing cultural and structural conditions influencing data use in schools. These four structures were: effective leadership, data use (datafication), the rise of accountability (individual) and an explicit school improvement agenda. These conditions are represented in Figure

5.3. The interaction between these four conditions and agents in the next phase was considered likely to produce some of the outcomes in the empirical domain. This preliminary hypothetical model of likely structures and mechanisms (see figure 5.3) was subsequently tested after empirical evidence and is reported in Chapter 6.
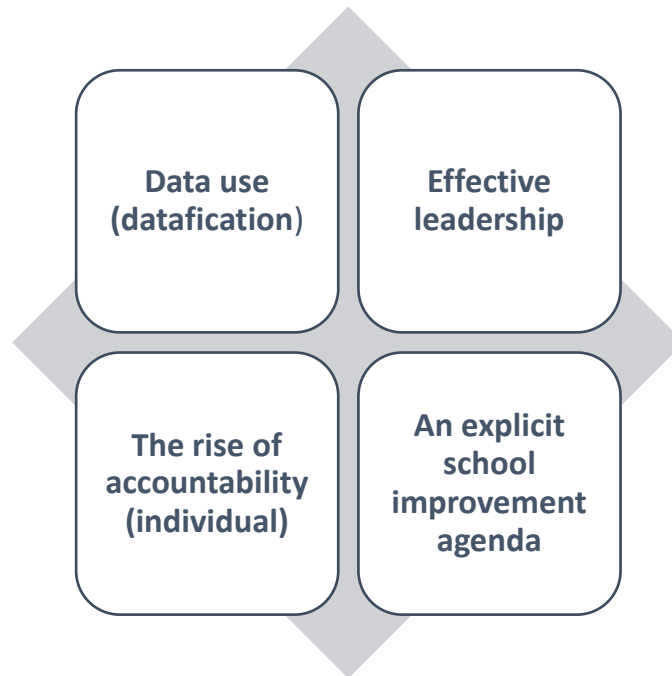
Figure 5.3: Four structural conditions likely influencing data use in schools

Tracing a history of emergence across several contextual strata has shifted the analytical focus from a theoretical framing at the infrastructural level, through revolutions in educational structures at an institutional level through to changes at a relational level. The next phase of the analysis investigated how these structural and cultural conditions were likely to influence at an individual agent level. A realist social understanding supports this move from the macro through to the micro recognising that these strata are relational and that explanatory understanding must eventually lie with agential interaction with these structural/cultural conditions. Accordingly, the next analysis stage focused on the socio-cultural interaction around data use to identify the generative mechanisms and subsequent conditions likely to enable or constrain agents at an individual level.

6. Phase Two Analysis

6.1 Introduction

Chapter 5 described previous cycles of structural and cultural change in education from an infrastructural and institutional setting perspective in an Australian context. Chapters 6 and 7 will focus on the consequences of those changes in relational and individual contexts in Queensland schools. Accordingly, these chapters describe and analyse the complex reaction of agents to new data use in schools. They explain how teachers respond to the structural and cultural arrangements stemming from policy reform and restructure. They examine the socio-cultural interaction between different emergent properties and direct attention to the new social relations that emerge as a consequence. This follows analysis outcomes in Chapter 5 identifying four emergent structural and cultural conditions likely to affect socio-cultural interaction in schools.

In Chapter 6, further refinement of this analysis through Stages 4-6 of the explanatory model reveals the extent different forms of leadership mediated these structural and cultural emergent properties. As a result, this analysis chapter sought to reveal the extent and scope of data use in four case schools, consequently answering the first of three domain-focused research questions.

- What are the key dimensions of data use in Queensland primary schools?

Accordingly, Chapter 6 is a general structural and cultural analysis of how the case schools at a *relational* level respond to new school improvement policies situated around data use. This initial confirmation of the structural and cultural arrangements of each school provides a background to Chapter 7, which examines agents' relationships with data at an *individual* level.

At each of these four levels (infrastructural, institutional, relational and individual) the aim has been to examine the level of systemic integration with social integration; in other words, analysing the interaction between structure, culture and agential action (Archer, 1995). The adoption of CM(A)O configurations as a means to describe these interactions signals a commitment to comparative analysis and a deeper understanding of the explanatory stories from each school (Gable, 2011). As discussed in Chapter 4, these interactions are described through analytic histories of emergence which may be articulated here as causal pathways expressed in the formula, context (C) + mechanism (M) <agency> (A) → outcome (O) or CM(A)O configurations. Accordingly, Chapter 6 refines the context (C) of these configurations by developing an understanding of the structural and cultural arrangements influencing the conditions in which teachers operate. It provides an expanded understanding of these relationships before refining the approach to an individual case level in Chapter 7.

This analysis continues the critical realist project by discussing both insights and research outcomes and their general relationship with theory in an ongoing movement between the abstract and the concrete (Danermark et al., 2002; Gable, 2011). This underlabouring supports a retroductive understanding begun earlier in Chapter 3.

6.2   Part One: Refining Objects of Knowledge

The structural and cultural conditions identified in the previous chapter were used as an entry point for analysis following the first stage of analysis. A preliminary hypothetical model was then developed from a retroductive analysis of the infrastructural and institutional settings and T^4 of the previous morphogenetic cycle outlined in Chapter 5.

The associated properties of the model can be expressed as follows:

- Effective leadership (capacity, performance and development)
- Data use and datafication
- School improvement agenda and initiatives
- Accountability performed at an individual level.

These emergent properties generated different forms of situational logics dependent upon the material or ideational qualities that characterise them. Accordingly, while they provided parallel forms of directional guidance for action, they were not necessarily in synchrony with each other (Archer, 1995). These are emergent properties, and the consequences of their interplay determined the different forms of action and reaction at the school and individual agent level. Transformation was then dependent on the interaction of the emergent properties with agents in the next cycle.

6.3   Exploratory Analysis

Recapping earlier data collection processes, a series of semi-structured interviews took place over five months and were digitally recorded and transcribed. The initial analysis consisted of open coding of the interview data guided by the conceptual framework which examined the data for likely relationships between structure, culture and agency in line with Archer's (Archer, 1995, 1996) social theory. This loose template coding formed the basis for the initial examination of the interview data and emerging further themes were then elaborated in consideration of opposing or corresponding cases. Examples of this coding process are included in Appendix B. In each instance, these new codes were included in the original template and data were re-examined across each of the cases.

While some early relationships emerged, the structural and cultural arrangements associated with data use across the four case schools were characterised by number and diversity. Data use in each setting appeared to draw from any number of practices and positions that targeted different agent roles and responsibilities in several ways across the four case schools. While some structures were predicated on school improvement processes, others were derived from cultures of accountability. Table 6.1 outlines the structural arrangements present in some or all schools.

Table 6.1: Structural arrangements associated with data use in each school

Structural arrangements - Data use	BrSS	CaSS	BoSS	WaSS
Systematic plan for the collection of data	●	●	●	●
Upgrading teachers' skill analysing data	●		●	●
School leaders design and implement data routines	●		●	●
School leaders monitor and assist teachers to set targets			●	●
School leaders set aside time for intensive data conversations	●		●	●
Principals report school data to supervisors (ARDs)	●	●	●	●
Leadership team regularly presents data to staff	●	●	●	●
Leadership team develops visualization tools (i.e. data walls)			●	●
Specialist school groups meet regularly and discuss data	●		●	●
Whole school approach to data use	●	●		
Principal adopts leadership text/philosophy/ ideational approach			●	
Data collected about all aspects of school life	●			
Professional learning opportunities recognised and undertaken	●	●	●	●
Teachers taking part in regular data routines	●	●	●	●
Teachers take part in target setting conversations based on student achievement data			●	●
Teachers take part in comprehensive data conversations	●	●		
Teachers engage with visualisation processes			●	●
Teachers contribute data to visualisation process			●	●
Principals aim to meet data expectations of ARD-SPs			●	●
Teachers take part in regular small group conversations around data	●	●		
All staff engaged in data processes.	●	●	●	●
Teachers respond to data imperatives		●	●	●

The 'pushes and pulls' of the social relations emergent from these structural arrangements were likely to be felt by the staff (Vidovich, 2009) although these structures appeared to co-exist

uneasily with each other. This is captured in these two comments from a principal (on leave) acting in a pedagogy coach role:

> I mean, basically, the role of principal in a small school is constantly changing—well, the data is just another thing—regularly you are given another hat to wear and you are meant to be the guru of whatever the initiative is that they bring out. For me, now, I was supposed to be instructional leader. My God "What do I know?" (CaSSPC1).

> Yes, because all of the schools are subject to pressure…from Education Queensland, and then the regions have their own agenda; and then— well, they set out the regional guidelines and achievement standards and each region has a different set. And then it is down to the school level, and it is really up to the principal then and his staff to decide what they can take on (CaSSPC1).

How these agents navigated the conflicting arrangements required insight into an emerging teacher agency and the development of an adequate conceptualisation of the term (Priestley et al., 2015b).

In this context, a clearly defined set of structures around data use may have existed in the schools; however, this initial analysis had not been able to find an entry point into the research space. The limited time spent in each school and the additional restricted access to a wider sample of participants were also problematic to the research process. This is addressed further in Chapter 8. Nevertheless, supplementary refinement of the preliminary insights into teacher response to new ways of knowing required a further dive into the critical realist toolkit and a return to Stage 4 of the explanatory model.

6.4   **Stage 4 – Retroduction**

Critical realism recognises that any number of generative mechanisms may be cooperating in an open system to explain a phenomenon. Stage 4, the retroductive stage of the explanatory process provides an opportunity to explore these possible mechanisms in a creative process where questions can be asked; for example, "what is fundamentally constitutive for the structures and relations around data use, highlighted in stage three, to be considered?" (Danermark et al., 2002, p.110). Is democratic data use or data agency possible? What properties must exist for data use to influence in the way it does? What causal mechanisms are related to data use? (Danermark et al., 2002). What data dimensions are influencing school interactions at certain points? As Danermark et al. (2002) note, answers to these questions are likely to be found in already established concepts and theory. However, the number of identified structural conditions operating in the school cases around

data presented a dilemma for identifying the structures (and/or cultures) that might produce them. A reconceptualisation was required.

Subsequently, to describe how generative mechanisms and their causal effects explain the research phenomenon entailed a return to Archer's (1995) understanding of social structures and the nature of emergence in a stratified world (See Chapter 3). She argues that the causal effects of social structures (and those of agents and cultures) can be explained by their possession of emergent properties (Elder-Vass, 2007). Archer (2010) notes:

> Emergence is embedded in interaction: in the latter "we are dealing with a system of interlinked components that can only be defined in terms of the interrelations of each of them in an ongoing developmental process that generates emergent phenomena—including those we refer to as institutional structure". Emergent properties are therefore relational: they are not contained in the elements themselves but could not exist apart from them (internal quote is from Buckley).

> (p. 245)

In other words, the properties of a given higher-level structure emerge from the interplay of lower-level objects, but are not derived from them or reducible to them (Bygstad, 2010). Therefore, the four structural conditions identified in earlier analysis can be identified as products of the interplay of these lower-order emergent properties; yet, further analytic distinction needed to be applied here. The analysis now relied on refining knowledge of these layers of emergence and their interplay. Importantly, narrowing the research gaze would support a deeper and more complete awareness of causality and the causal pathways connecting mechanisms across different strata (Wynn & Williams, 2012).

In the previous chapter, it was noted that the emergent structures from the complicated social interactions of the previous morphogenetic cycle had produced a complex context where school improvement and accountability discourses were now likely to be entwined in school-based interactions. From this perspective, school improvement and accountability as structural and cultural emergent properties identified in Chapter 5 had enough generative power to produce the four structural conditions. As noted, both structures provide agents reasons for doing things; however, both are complex with multiple relations between their elements. As co-occurring contexts for interaction in schools, the research returns to making sense of how agents deal with the diverse strategies that emanate from a school improvement agenda and the responses new accountability policies engender in teachers. This is further complicated by the expanded processes

and tools designed to foster data use. These co-occurring structures presented challenges for the research process.

The point of contact between structure and agency, that is, the location or domain where transformation or stasis takes place, is referred to by Bhaskar (1998) as the mediating system and by Archer (1995), the position-practice system. Here, the position-practice systems that agents occupy "consist of positions (filled by individuals) and practices (activities)…where position refers not only to roles occupied by individuals, but also the situations and contexts in which they find themselves" (Thursfield & Hamblett, 2004, p. 119). Consequently, there is always the potential for the nature of social structures to be mediated by the position-practice system through the agency of agents and the corollary is the continuing conditioning of agents through their occupancy of particular positions and roles (Archer, 1995; Bhaskar, 1979).

The outcome of two co-occurring structures directing new uses of data is that each structure might require an agent to operate within two sets of positions and practices (Gable, 2011). The duties and responsibilities associated with one position-practice system might be directly contradicted by the multiple, contradictory material and ideational influences of the second position-practice system. How they interact, therefore, is the socio-cultural phase of the morphogenetic cycle. What emerges relies on the complex interaction between structure, agency and culture. More specifically, it depends on the interaction of the individual agent's "personal capacity for decision making and the ecological conditions within which agents work" (Wallace & Priestley, 2011, p. 362).

The previous chapter documented school improvement, accountability, and new leadership policy interventions as structural and cultural emergent properties likely to have enough power to be causally influentially in new data initiatives in schools. The structural arrangements associated with data use are, therefore, likely to be explained by the interaction between these three properties. However, the number and complexity of these structural arrangements required further separation into component parts. Accordingly, this next section moved to separate the possible cultural forms, social structures and human agencies influencing outcomes by returning to the respective knowledge domains to isolate (abstract) and compare the possible theories.

6.5 Stage 5 - Comparison between Different Theories

Stage 5 of the explanatory framework considers the relative power of the different perspectives to determine which holds the greater explanatory capacity (Danermark et al., 2002). This might not always be hierarchical as often theories might be balancing each other as they focus

on relatively different, though necessary conditions (Danermark et al., 2002). In order to build superior explanations of the interconnections between strata explaining the difference between structures, we must either bring in or develop other theoretical resources. Therefore, adding theory to data, in this case, supports "a (further) reconceptualization of the subject and the processes in which it is connected" (O'Mahoney & Vincent, 2014, p. 20). Accordingly, a brief consideration of the knowledge base concerning school improvement and accountability was undertaken.

An earlier literature review indicated a contemporary branch of knowledge emerging from the availability and prevalence of data across many domains, including education. To capture this, the analysis sought to provide a theoretical background to datafication. Accordingly, this examination considered school improvement, accountability and leadership only in relationship to data use in schools. While both are recognisably separate fields of study or at least subsets of fields of study, they often intersect and overlap. What is of interest here is the interaction of these structures with new modes of data use. In this respect, the data-based leadership of schools is considered part of the structural emergent property of school improvement, and the different forms of accountability induced in agents by the rise of data use are considered cultural phenomena. Each of these inform the organisational and political context within which the processes of data use take place in each case school (Coburn & Turner, 2011b).

6.5.1   An Explicit School Improvement Agenda

School improvement constructed as discourse is something few can argue with. It is central to policy direction, and the focus combines a sense of productive outcomes in an umbrella term that serves as a general cry for the pursuit of educational excellence. More recently, however, it is often teamed with other words that narrow that focus such as *explicit*, *strategic, targeted* and *data-driven* (Loughland & Thompson, 2016) in an over-simplification of the complexities of the new management aspects tied to the day-to-day school structure.

Drawing attention to the microprocesses of how school improvement actually takes place, highlights the relationship between shared accountability and individual agent action (O'Day, 2002). As previously discussed, while the school is the unit of intervention, the individual agent, the teacher or principal, is the unit of action (O'Day, 2002). In this respect, for transformation to occur, the interactions between teachers and principals must, in some way, bring about change at an individual agent level. However, this emphasis on individual agency may be problematic, given the policy features that seek to regulate teachers' work have tended to erode principal and teacher autonomy (Priestley et al., 2015b). This continues to occur in a policy space where school improvement and effectiveness discourses emphasise the "quality and capacity" of the individual

principal/teacher rather than taking into consideration the "multiple contexts and conditions" in which these agents practise (Priestley et al., 2015b, p. 126). Further understanding of how these structural and cultural tensions interact with educational policy to either enable or constrain the emergence of agency might be found in individual beliefs of principals and teachers.

The previous chapter identified a new policy focus on leadership practices that might be causally influential at the school level. Principals were identified as likely to have enough power to negotiate and mediate the different position-practices system associated with the new focus on school improvement coupled with the rise of data used for the purposes of accountability.

> The school leadership team have established and are driving a strong improvement agenda for the school, grounded in evidence from research and practice and expressed in terms of improvements in measurable student outcomes. Explicit and clear school-wide targets for improvement have been set and communicated to parents and families, teachers and students, with accompanying timelines.

> (ACER, 2010; 2013, p. 2)

These external improvement policies grounded in the technical, managerial discourse of evidence, measurable outcomes and target setting appear to deny a certain degree of principal agency. However, during this interactional phase, there continued to be alternatives to these power imbalances. Rather than just power-induced compliance, other sources of change could be found in the "confluence of desires" and certain modes of "reciprocal exchange" (Archer, 1995 p.296). In other words, both power relations and exchange transactions can be responsible for the change that happens at the school level.

These alternative themes resonate across the four cases where each principal operated according to their individual beliefs, and within the structural arrangements engendered by new policy directions. An example of this intriguing dynamic where principals functioned independently yet were subject to external structural arrangements is evidenced in a "charter of expectations" document distributed by one principal to staff:

> *This charter of expectations is a guide to provide direction and support to all staff members. It aims to ensure a consistent and clear approach to teaching and learning across our small school environment. It also supports the implementation of the Myrtaceae Educational Region Plan*

> - *Three pillars priority*

- *Strong curriculum and pedagogy*
- *The purposeful use of **data***
- *School-wide process for teacher capability development – **Coaching and feedback***

  - *Improvement and cluster development strategy*

The expectations made within the document provide a starting point for teachers to begin and at no point should teachers lose their gift to think for themselves and pro-actively for the sake of the children in their classroom and wider school community.(extracted from Corymbia SS Outlook, 2015, p.1).

The initial framing language of the document appears to reflect school policy that speaks to performativity and school improvement while the latter paragraph emphasises teacher agency in the face of these expectations. Further documentation reveals a data plan and priorities for the school year.

What progress milestones are the ARDs expecting by December?

What are the ARD[23] expectations regarding Aboriginal and Torres Strait Islands Perspectives in Schools[24] (EATSIPS)?

What are the expectations of teachers' practice?

What should ARDs and principals expect to see in classrooms?

What data do ARDs expect will underpin this work?

(extracted from Corymbia SS Outlook, 2015, p.2)

An intensive focus on 'expectations' evidences the mixed messages that characterise these exchanges between principal and staff in order to facilitate change. On the one hand, the principal signals compliance, review and evidence-based target-setting and accountability, and on the other a subtler recognition of teacher professional identity, where he suggests teachers should continue to think proactively for themselves. This ability to mediate emergent properties characterises this principal as a social actor, whereby his social identity is emergent from the role he has invested in

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[23] Assistant Regional Director (ARD)

[24] "The EATSIPS guide is a tool for schools to use to help them to build long-lasting, meaningful relationships with Aboriginal and Torres Strait Islander people to improve Indigenous student learning outcomes, and to provide all Australian students with an understanding of, and respect for, Aboriginal and Torres Strait Islander traditional and contemporary cultures" (Education Queenland, 2008, p. 13).

and has now come to occupy (Archer, 1995). It recognises his ability to negotiate and mediate the different position-practices systems from the structures of school improvement and accountability. This emergent agency is something that will be discussed further. For now, it foreshadows arriving at a distinction between a restricted professionalism based on forms of technical-managerial accountability and the possible emergence of "an extended professionalism, characterised by professional judgement and professional agency and the accordance of trust" (Priestley et al., 2015b, p. 134).

The recognition that those with a leadership and management focus were more aware of the outside systemic demands was further evident in another case school where the principal more actively engaged with an explicit improvement agenda. He comments:

> You know the expectations from the department are very clear, and we all understand them. I've got a very short, sharp improvement agenda that my staff work around, and I've looked at the data and I *can explain to my staff* why we came down that path. My improvement agenda is reading, spelling, problem-solving and mental computation, and so those are the areas we focus on as a staff (WaPr1)[25].

This understanding of teachers' work and data use directly affects the nature of relations between teachers and the principal. The performative culture that emerges in this school setting is one where target-setting and surveillance offer explicit challenges to the traditional ways of doing things. Here, data use influences the power relations on different levels, as measures of control external to the school have a direct effect on the internal workings of the school. The principal, as a social actor, then mediates the position-practice systems generated by school improvement and accountability to reshape the power relations between the leadership team and the teachers (Bloxham et al., 2014). The cost of this target setting and surveillance is a culture that, in some ways, belies teacher agency and removes the opportunity for an extended or more democratic professionalism (Biesta, 2004).

The concept of an explicit school improvement agenda may be responsible for some of the new structural arrangements around data use in the case schools. However, these arrangements were neither standardised nor recognisably similar across the cases despite being in response to external policy systems designed to change the internal operations of schools in general. This approach seemed to rely on how willingly principals were prepared to engage with and convey these new

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[25] Participant interview data is deidentified and coded Waterhousia State School Principal (WaSSP).

expectations to staff, and ensure they were operationalised. It appeared that, while the positions and practices associated with school improvement were in themselves powerful, principals were still able to mediate these emergent properties. The initial bargaining power of principals engendered through individual beliefs and agency, specified, yet did not determine the outcome of these agential interactions. Individual teachers were still able to bring their own form of agency to the data interaction phase. This is further examined in the next section.

6.5.2 Data Induced/Influenced Accountability

The rise of accountability in education is documented in Section 2.3 and not repeated here (Ball, 2008; Biesta, 2004; OECD, 2013; Poulson, 1996; Rizvi & Lingard, 2010). Understanding how data induced/influenced accountability in the form of data-driven practice and logics are reshaping the possibilities for teachers is less well represented in research (Lewis & Holloway, 2019). There was some evidence to suggest that the level of experience of the teachers involved affected the types of interaction that occurred with the data. A highly experienced teacher saw herself as operating within a school, however following her own "set of rules" around data use in the classroom. At an individual level, she used the NAPLAN test as a driver of what occurred in the classroom (Henman & Gable, 2015). She commented:

> The thing that has really pushed me has been the NAPLAN test. I know the data we are going to get from the NAPLAN test, I know the kids are going to do it, they are going to be measured, and I know we are going to be judged against that (CoSST1).

Here data-induced accountability is considered through the affordances of teacher agency, the outcome being the emergence of restricted and/or extended/democratic forms of professionalism (Priestley et al., 2015b). This lens also weighed up what the contribution might be of "the variable ways in which power and participation are constructed and enacted" (Couldry & Powell, 2014, p. 1) in bottom-up data practices (Milan & Van der Velden, 2016). By what means were teachers able to navigate these position-practice systems to emerge with their own form of agency?

A further consideration was what role might datafication or new ways of knowing schools through data—the technical practices, the social values and ideational understanding—play out in "an emergent alternative epistemic culture?" (Milan & Van der Velden, 2016, p. 69). In this respect, explanatory power lay in the investigation of the individual/collective action, the actual data processes in schools that took place and the accompanying properties and interrelations that emerged. Coburn and Turner (2011b) argue that the outcome of data interactions is influenced by three factors:

- Noticing, interpreting, visualisation and constructing implications for action
- Beliefs, knowledge and motivations (restricted and extended/democratic professionalism)
- Social interaction

Accordingly, teacher data sensibilities and understandings were likely to be driven by modes of data interaction in addition to their personal beliefs and prior knowledge. However, recent research has indicated that the new ways of knowing and the 'knowability' of schools afforded by datafication have fashioned new social relations around data use. Lewis and Holloway (2019) argue that:

> Data created expectations amongst teachers to openly profess data responsive attitudes and dispositions and to embody these data-informed renderings of self. Our analyses reveal that teachers in our schools were most valued for demonstrating a disposition favourable to data, were amenable to being represented by data and ultimately sought to improve data over other educative practices (e.g., pedagogy).
>
> (p. 37)

This privileging of data use over other education practices suggests a need for a 'critical engagement' with data-use practices and their outcomes in order to reveal associated problems and issues. By examining the competing nature of the structural arrangements that emerge, it is possible to consider datafication and its socio-political consequences (Milan & Van der Velden, 2016). Here, an emancipatory or CR approach might direct attention to the central paradigm shift produced by datafication (Milan & Van der Velden, 2016; Ruppert et al., 2017).

In summary, the structures of school improvement and accountability, influenced by intensified data use processes established within schools, reflect sometimes competing, sometimes complementary bodies of knowledge addressing different positions of attention and motivation. Consequently, the agents within each school rely on theoretically informed practices to establish the new data conditions and processes that were often unique to each school setting.

6.6 Co-occurring Structures with a Meta-Mechanism

Stage 5 of the explanatory model considers the relative explanatory power of mechanisms and structures abducted during Stage 3 and Stage 4. Which structures might be most influential in each case? In examining the nature of the structural arrangements that emerge from conflicting theoretical positions (and the corollary policy outcomes), attention is directed at the emergent

potential of these competing co-occurring structures in relation to consequences experienced by teachers in schools. A social realist analysis places the interactions that happen between agents in the social space at the centre of any analysis (Case, 2013). In the school setting, therefore, these are interactions between principals and ARDs, between principals and teachers and between teachers and other teachers/teacher aides. These interactions can be separated analytically by distinguishing between the interactions that are "structurally conditioned because of different positions and resources that the agents involved possess and those that are culturally conditioned because of the ideas and knowledge" that are held by those involved (Case, 2013, p.47). For this reason, principals might enact certain school improvement policies and processes according to the causal influences emergent from the realm of structural properties at the same time as attempting to negotiate a set of ideational properties entrenched around teacher professional knowledge.

These tentative conclusions were presented in a table (see Table 6.2) designed to separate what structural and cultural arrangements might be the outcome either of the meta-structures previous discussed.

Table 6.2: Structural and cultural arrangements vs meta-structures

Structural and cultural arrangements	
Leadership and school improvement	Data-induced accountability
Systematic plan for the collection of data	Data collected about all aspects of school life
Upgrading teachers' skill analysing data	Professional learning opportunities recognised and undertaken
School leaders design and implement data routines	Teachers taking part in regular data routines
School leaders monitor and assist teachers to set targets	Teachers take part in target-setting conversations based on student achievement data
School leaders set aside time for comprehensive data conversations	Teachers take part in comprehensive data conversations
Principals report school data to supervisors (ARDs)	Principals report data to supervisors (ARDs)
Leadership team regularly presents data to staff	Teachers engage with visualisation processes
Leadership team develops visualization tools (i.e., data walls)	Teachers contribute data to visualisation process
Specialist school groups meet regularly and discuss data	Teachers take part in regular small-group conversations around data
Whole school approach to data use	All staff engaged in data processes.
Principal adopts leadership text/philosophy/ ideational	Teachers respond to professional development

How this plays out in each school now depends upon levels of agency and the degrees of interpretative freedom and directional guidance inherent in these interactions, and what kinds of rewards or penalties are associated with particular courses of action (Archer, 1995). Accordingly, the numerous structural conditions identified earlier in relation to data use in schools might not relate to either school improvement or accountability structures alone. Here the central role of the phenomenon of emergence comes to the fore, where the structural arrangements in evidence might be seen as a blend of both meta-structures with new properties that should not be seen as just the sum of the original components.

To consider how these new positions and practices around data use might be negotiated by individual agents' further analysis was instituted and the last stage of Danermark et al.'s (2002) explanatory model of social science was applied.

6.7   Stage 6: Concretisation and Contextualisation

The final stage of the explanatory framework examined how the influence of these structures and mechanisms might become apparent in the concrete reality (Danermark et al., 2002). This stage relied on considering the explanatory logic in the ways in which these mechanisms interact with other mechanisms across levels and in different contexts in the actual world. Here the researcher is careful to distinguish between what is accidental and what actually relates to the structural and cultural conditions under study (Danermark et al., 2002). Again, these theoretical concerns are empirically supported in a process that entwines theory with practical outcomes. Archer argues that "At every level the tendential powers of generative mechanisms are complemented and supplemented by a historical analysis of the concrete contingencies which intervened to produce particular outcomes" (Archer, 1995, p. 327). Therefore, the original structural and cultural conditions were re-examined in light of the proposed theoretical model for their possible insight into data dimension interaction at the school level (Gable, 2011).

The numerous data use examples from schools drawn from the empirical data identified in the first instance were expanded and recoded. An example is included below (see Appendix E for the full table). As indicated previously, the sometimes-overlapping meta-structures resulted in further, sometimes conflicting combinations of processes of data understanding and use (see Appendix E). What emerges are seven characteristic data dimensions. In no particular order these are: data use and professional identity, data interaction-communication, data target-setting and surveillance, data norms, data as resource, data and professional learning and data visualisation. These dimensions are used to describe the ways in which structural and cultural arrangements are

interacting with agential action in each case school. Here a form of data reduction has organised data into a more manageable framework. These analytic choices are then displayed in Figure 6.1.

Table 6.3: Extract from coding document emergent properties vs data abstractions

EMs	Data abstractions	EMs	Data abstractions
Data use and professional identity	Principal adopts leadership text/philosophy/ ideational Schools are about relationships Principals rely on external support networks Specialist teachers have expert knowledge about data and new educational practices Master teachers are users and contributors to research Principals apply an explicit school improvement agenda Principals are instructional leaders Data is just part of constant systemic change Whole school approach to data use Data as part of workload Data is used to inform pedagogy Principals manage multiple relationships Data use is a whole school process Data is valued for its usefulness Teaching is far more demanding now Data confirms what teachers already know Data underpins school improvement Teachers have a professional understanding of student progress	Data-interaction communication	School leaders design and implement data routines Leadership team regularly presents data to staff Specialist school groups meet regularly and discuss data Teachers build relationships with each other Principals build relationships with teachers and teacher aides Principals facilitate formal and informal data talks with teachers Specialist teachers assist classroom teachers to improve data practice Data is used to make conversations Principals manage multiple relationships Data use is a whole school process Leadership team support professional conversations about data Teachers use data to take part in professional learning conversations Teachers are expected to work in teams Data processes are seen as time consuming Teachers need a common terminology with which to discuss data and improvement Teachers take part in data conversations and talks for improvement Teachers believe in effective

Regrouping themes provided the opportunity to consider the outcomes of the interaction between the structural and cultural properties and to recognise when to stop further development (King, 2004). The capacity of template analysis for both linear and depth analysis supports an ongoing dialogue between existing theories and the outcomes of empirical research. Subsequently, new terms of references around data use and processes were constructed that provided an improved perspective of the research phenomena (Cruickshank, 2003). Danermark et al. (2002) argue that this final stage should outline how mechanisms interact with other mechanisms across different levels and how describing these mechanisms gives rise to explanations of concrete events and outcomes. Here then there was an opportunity to test the meanings emerging from the data against the theory of co-occurring structures and the possible emergent outcomes.
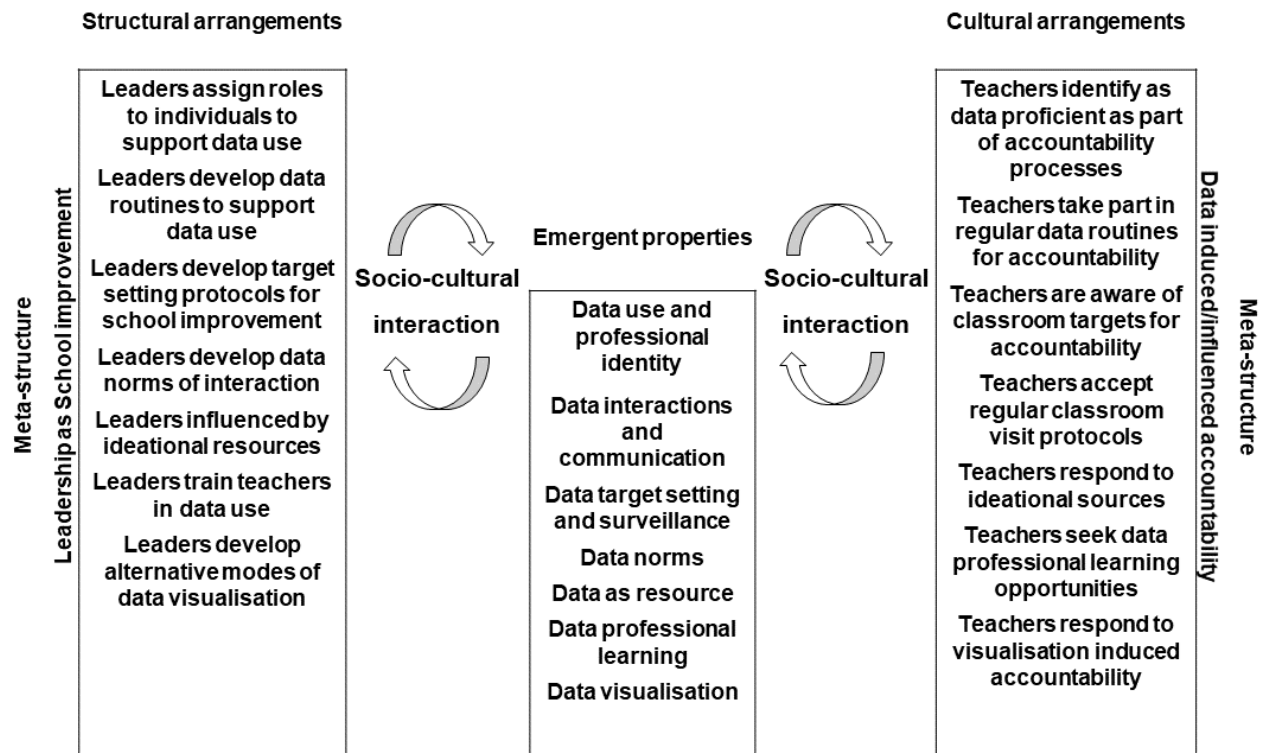
Figure 6.1: Data use and emergent properties interact as new data dimensions (following Gable, 2011)

6.8   The Morphogenetic Cycle and Model Building

Making sense of this context in the realist sense might be accomplished by fleshing out a model of the social-cultural interactions to test against empirical data in the final analysis chapter. Here it should be noted the inherent structural and cultural constraints of the restructuring of the Queensland state education systems which place an explicit school improvement agenda and the analysis and discussion of data at the core of school leadership business. Accordingly, a social realist understanding of the new structural and cultural arrangements that emerge via this analysis might be posited as:

- Data and the numerous data use processes are manifestations of the structural and cultural arrangements and work to both enable and constrain teacher agency.
- Teachers engage with these new arrangements according to their previous experiences and own highly developed properties and powers relating to their professional identity.
- Leadership teams rely on interaction with and through data to move the school improvement agenda forward sometimes at the expense of teacher agency.
- For principals to succeed in a data induced accountability context requires meeting new target-setting and data expectations. The logic of this situation constrains the possibilities for

principals to engage in building professional teaching teams focused on data use in a purposeful manner ensuring long term success.

- Leadership interaction and support are key enablers of positive teacher outcomes. These interactions are conditioned by broader social dynamics and discussed in Chapter 5. Both the principal and the master teacher have the greatest potential to craft situational logics with regard to teachers building forms of teacher agency.

- Extended data collection and use may be viewed in two ways; as an excess which situates data collection as an onerous task that takes teachers away from the core business of teaching or a critical task to ensure essential improvement in school outcomes.

- New forms of data visualisation support the enablement of new forms of teacher accountabilities.

Accordingly, a refinement of Archer's morphogenetic cycle offered an initial hypothetical model of how the emergent properties of two co-occurring structures, might interact and establish (and indeed prioritise) a new set of positions and practices around data use at an individual agent level. The numerous structural arrangements around data use identified at the school level were proposed as emergent from the interactions between the structural properties of leadership-driven school improvement processes and the cultural forms of data-induced accountabilities. This tentatively confirmed the advantage of building analytic histories of emergence on different scales and at different levels across the research space (Archer, 1995). An earlier understanding recognised principals as social agents likely to have sufficient power to negotiate different position-practice systems associated with new improvement policies. A second interpretation linked forms of accountability with the ascendancy of data use and professionalism in schools.

6.9 New Perspectives

This analysis examined the four cases concurrently while looking for an entry point into the final casing of the phenomena. Accordingly, analysis of the interaction between the structural and cultural structures of leadership for school improvement and data-induced accountability identified seven emergent properties which focused agents' attention to data use at the relational level (see Appendix C). The different positions and practices associated with these properties and the likely variation in social relations emergent from agent interaction with these properties at the individual level signalled uncertain outcomes for school cases.

The proposed model of emergent properties likely to shape agents' responses at an individual level is influenced by the different forms of directional guidance and power relations inherent in these emergent properties and the reflexivity of the agent. Given the fluid nature of

education research settings, nothing is certain. Consequently, these tendential conditions need to be further examined to understand their potential in concrete situations (Archer, 1995). Following Gable (2011), each emergent property is mapped to empirical research perspectives informing the meta-structures of leadership for school improvement and data-induced accountabilities (See Table 6.4). Each perspective provides insight into potential generative mechanisms to inform the next analytic stage. These co-occurring structures continued to influence agential action at the individual level examined in Chapter 7.

Table 6.4: Emergent properties mapped theoretical perspectives of co-occurring structures (adapted from Gable, 2011)

Data use and professional identity	Professional identity supported by knowledge and beliefs around data use. (Coburn & Turner, 2011b; Lewis & Holloway, 2019)
Data interactions and communication	Recognises that principal and staff interact around sets of data for different purposes (Earl, 2008; Earl & Katz, 2006; Little & Curry, 2008; Timperley, 2008)
Data target setting and surveillance	Reflects relations of power and authority that develop around performance data (Anagnostopoulos et al., 2013; Ball, 2000; Ball, 2003; Kitchin, 2014; Lawn, 2013c; Lingard, 2011; Lingard & Sellar, 2013; Williamson, 2016)
Data norms	Reflects the new norms of interaction that are emerging from data routines (Hardy & Lewis, 2016; Lewis & Hardy, 2017; Lewis & Holloway, 2019; Scott, 2013a; Selwyn, 2016)
Data as resource	Describes role of data in resource exchange and its relative value within cases (Anagnostopoulos et al., 2013; Archer, 1995; Selwyn, 2016)
Data professional learning	Acknowledges levels of data expertise and necessary capacity building (Coburn & Talbert, 2006; Colyvas, 2012; Daly, 2012; Earl, 2008; Earl & Timperley, 2008c; Timperley, 2008; Turner & Coburn, 2012)
Data visualisation	Describes the influence data visualisations have on data interaction and teacher engagement (Anagnostopoulos et al., 2013; Lawn, 2013a; Sharratt & Fullan, 2012; Williamson, 2016)

6.10 In Summary

This analysis stage extracted structural arrangements around data use present in the case schools from the research data. The number and diversity of these arrangements were likely in response to the multiple policy directions, funding opportunities being directed at schools and individual principal agency. Returning to a morphogenetic approach, the analysis considered how the interplay between these arrangements might influence each school at a relational level. To facilitate this, Stages 4, 5 and 6 of the explanatory model of critical realism (see Chapters 3 and 4)

were enacted to determine which arrangements might provide further understanding at the school level.

This movement between theory and data continued to respect the ontological, methodological and epistemological assumptions of CR and support a robust and coherent explanation (Lipscomb, 2014). The processes of retroduction and theory comparison reconsidered the data from an Archerian perspective where the meta-structures of school improvement and accountability were likely to interact, the result being new emergent properties. However, given the different theoretical stances of each, the different position-practice systems that agents operating within these structures might have to negotiate were considered challenging (Gable, 2011).

It was earlier argued that that principals as leaders were likely able to negotiate and generate the connection between new data policies and teachers. What emerged from this three-way analysis of structural (school improvement), cultural (accountability) and agential interaction is the identification of seven emergent structures relating to data processes that may be functioning within each school. This further refined the earlier research question and offered an initial understanding of the domain-focused research question:

What data dimensions are operating in the school?

1. Data use and professional identity
2. Data interactions and communication
3. Data target setting and surveillance
4. Data norms
5. Data as a resource
6. Data and professional learning
7. Data visualisation

These refined emergent properties were present in all the case schools. Further analysis indicated that the outcome of processes of data use might be contingent on agential beliefs, knowledge, motivation and social interaction. Accordingly, the next stage of analysis in Chapter 7 considers the interplay of these variable emergent properties with individual agents to determine the mechanisms and likely conditions that bring change or reproduction of the social relations surrounding data use in each case.

7. Casing the Schools – Teacher Data Agency and Relationships with Data

7.1 Introduction

Chapter 5 established the initial context of the analysis by identifying four cultural and structural conditions (an explicit school improvement agenda, effective leadership, data use or 'datafication', and the rise of accountability) likely to produce the situational logics influencing how teachers worked with data in each school. These emergent conditions were further refined and explained through the analysis of the interview data in Chapter 6, and seven dimensions were identified and considered likely to support a more granular analysis of the data. Chapter 7 presents four case-schools and establishes the CM(A)O configurations that support middle-range theorising, utilising theory to describe causal inferences and a comparative evaluation of the emergent social relations in each school.

This chapter describes how teachers and principals are working within the new structural and cultural conditions emergent from an intensified data focus in schools. It aims to re-position the analysis to the individual teacher level in order to examine the implications and impact of data in the school setting. It seeks to articulate the conditions under which a form of teacher data agency might be achieved, an agency that recognises the professionalism of teachers and supports their professional learning concerning data. This follows Phase I and 2 outcomes of the study identifying seven emergent properties related to data likely to be influential. Subsequently, this final analysis phase endeavours to reveal the contexts and mechanisms that may or may not support the development of productive agent action concerning data, and the emergence of a teacher data agency.

This relocates the analysis from a high-level methodological discourse to the analysis of empirical research and the development of specific theories. Analysis in this chapter focused on answering the following domain-focused research questions:

- How does engagement with data inform professional practice and teacher learning in school contexts in Queensland primary schools?
- How might the social relations of data use constrain or enable principal-teacher agency within the Queensland primary school setting?

7.2 Revisiting CM(A)O Configurations

This third analysis stage aimed at locating the mechanisms (M) that interact with context (C) to produce final outcomes (O). The search for underlying or generative mechanisms can be understood as part of a research *process* that describes how subjects interpret and act upon the context in question. Accordingly, "a mechanism is not a variable but an account of the makeup, behaviour and interrelationships of those processes which are responsible for the regularity" (Pawson & Tilley, 1997, p. 67). Here, mechanisms refer to "the engines of explanation embodied in an agent's reasoning and their selective attention to the disparate resources available" (Herepath et al., 2015, p. xviii). In other words, the analysis project is to produce a theory that can explain the potential of a mechanism to produce an outcome in a particular circumstance (Pawson & Tilley, 1997).

CM(A)O configurations articulate the similarities and differences between certain contexts and mechanisms, and what effect these combinations have on various outcomes (Harrison & Easton, 2004). The inclusion of agency foregrounded the mediation role that actors and agents play in these causal configurations and outcomes. This is the basis for a comparative analysis of outcomes, from which a series of causal explanations are constructed in each case setting. These alternative pathways presented an opportunity to determine more than 'what works?' as they focus on why it might be working by examining contexts which may or may not trigger mechanisms in certain circumstances (Pawson, 2008).

This explicit use of Pawson and Tilley's (1997) data analysis method sought to overcome the methodological complexity that emerged from the adoption of Archer's morphogenetic approach. These compensations and limitations were foreshadowed in previous chapters, and I return to Ackroyd (2004) for methodological support, who advises the painstaking reconstruction of these causal mechanisms through "iterative empirical research guided by theory" (p. 155). Accordingly, this stage sought to identify the generative mechanisms and outcomes through further analysis of data and regular recourse to theory.

7.3 Early Understandings

In this final stage, the analysis challenge lay in developing accounts of how and why school leaders and teachers were responding to new uses of data at an *individual* level. Interview data were re-examined in the context of the seven data dimensions identified in Chapter 6. This retroductive analysis sought to clarify the fundamentals (the basic conditions) of social relationships, reasoning, awareness, knowledge and agents' actions to explain the circumstances in which a phenomenon

exists (Meyer & Lunnay, 2013). For example, the researcher might ask the question of what the pre-conditions are for teacher (data) agency to exist. Priestley et al. (2015b) might argue that strong external relationships make it possible for teachers to contest and interrupt previous ways of thinking about their data practice, while Earl and Timperley (2008) propose that relationships of respect and challenge are responsible for the emergence of new modes of thinking around data use. What then are the concrete and transcendental pre-conditions for teacher (data) agency? Here it is reasoned, "relating research phenomena to new frames of reference through abduction and retroduction" makes possible the development of new ideas and new connections about something already known, but now conceptualised by the researcher in a different context (Meyer & Lunnay, 2013, p.8). This new injection of perspective supported further theory development while continuing to consider the body of knowledge that already existed (Layder, 1998). This is a hallmark of a retroductive methodology where there is constant movement between theory, method and empirical data and is reliant on abstraction to tighten the focus on likely causal options.

7.4 **Individual data perspectives and role responsibilities**

Individual principal/teacher interview data were coded against conditional data emergent properties (data dimensions) using a modified coding template. This data is presented table 7.1 and is visualised at an individual teacher level in Figure 7.1. The aim was to seek an explanation of what might influence how the individual perceived their interaction with data and the subsequent consequences of that interaction. This process follows Crinson (2007) who argues that drawing on a cross-section of Archer's morphogenetic model, a moment in time, then "the dynamic of (data use) practice is assessed utilising (teachers') own discourses of practice at a time of organisational transition" (p. 35). This conceptualisation hinges on emergence and the explanatory purchase it provides in these circumstances where individuals have to consider their options and decide on a course of action (Case, 2013).

Accordingly, the preliminary analysis focused attention on individual responses to the emergent data structures previously identified. Not surprisingly, given the different position practices and roles occupied, there were variations in reactions and emphases from individual respondents. In the course of the coding, data use and professional identity, data interactions and communication, and data target-setting and surveillance were the three structures which related most to other structures and were accorded the most emphasis across the individual principal and teachers.

Table 7.1: Data dimensions disaggregated for individual teachers and principals

	Botanica					Brushbox		Corymbia				Waterhousia			
	Principal	MT	T1	T2	T3	Principal	T1	Principal	HC	T1	T2	Principal	Deputy	MT	T1
Professional identity	40	57	17	16	30	30	29	47	11	22	9	18	11	26	21
Interactions	28	43	13	14	18	20	9	32	6	10	8	14	12	21	10
Target-setting expectations	19	35	17	10	24	31	18	33	22	25	16	30	21	30	19
Resource	10	18	3	9	18	7	3	9	1	6	1	3	4	6	5
Professional learning	19	27	7	7	11	6	8	13	4	8	2	8	10	27	5
Visualisation	12	18	6	3	10	8	1	11	1	1	4	5	14	8	8
Norms	7	3	2	0	4	0	1	3	1	1	1	1	1	0	0

This distribution presented in Figure 7.1 supports previous research which notes that individual beliefs, knowledge, and motivations influence teachers' response to data and data use (Coburn & Turner, 2011b; Wallace & Priestley, 2011). An another determinant is the nature and patterns of the social interactions in which data use takes place (Earl, 2008; Earl & Timperley, 2008; Mandinach & Gummer, 2016; Mandinach & Jimerson, 2016). A further influence predicated on the concentrated professional development of data skills in teachers is evident in the interaction between master teacher and teacher (Mandinach & Jimerson, 2016) and the focus on data as a resource likely to support teacher knowledge and professional learning. Of the seven emergent properties 'data and professional identity' which included agential beliefs and knowledge of data coded most strongly. Tellingly data, permeated most of the conversations on different levels. Presented below are a selection of quotes from just one teacher from a high performing urban school:

> Really, we learn and grow, based on research and data and statistics. So, I think our accountability now, in terms of education, is so much greater than it ever was (WnSST1).

> This is the power behind the - and this data has pulled people; it's forced people to get together and talk. It's forced the hubs of the school to have to start to connect (WnSST1).

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So, in my eyes, I see the need to make this data visually accessible, quickly, for principals and teachers to snapshot (WnSST1).

But we weren't going to be accountable; but now - see, with this data, it's driven people; you have to sit and talk; you have to work together; you have to be accountable on all areas (WnSST1).

The other six properties were also present within each interview transcript pending which role or responsibility was held by the individual. It should be noted here that these coding outcomes should be considered as tentative only, however, this exploration cautiously confirmed the appropriateness of the framework for conceptualising how data-use policies are understood and how they shape or might be shaped at the agential level (Danermark et al., 2002; Gable, 2011).
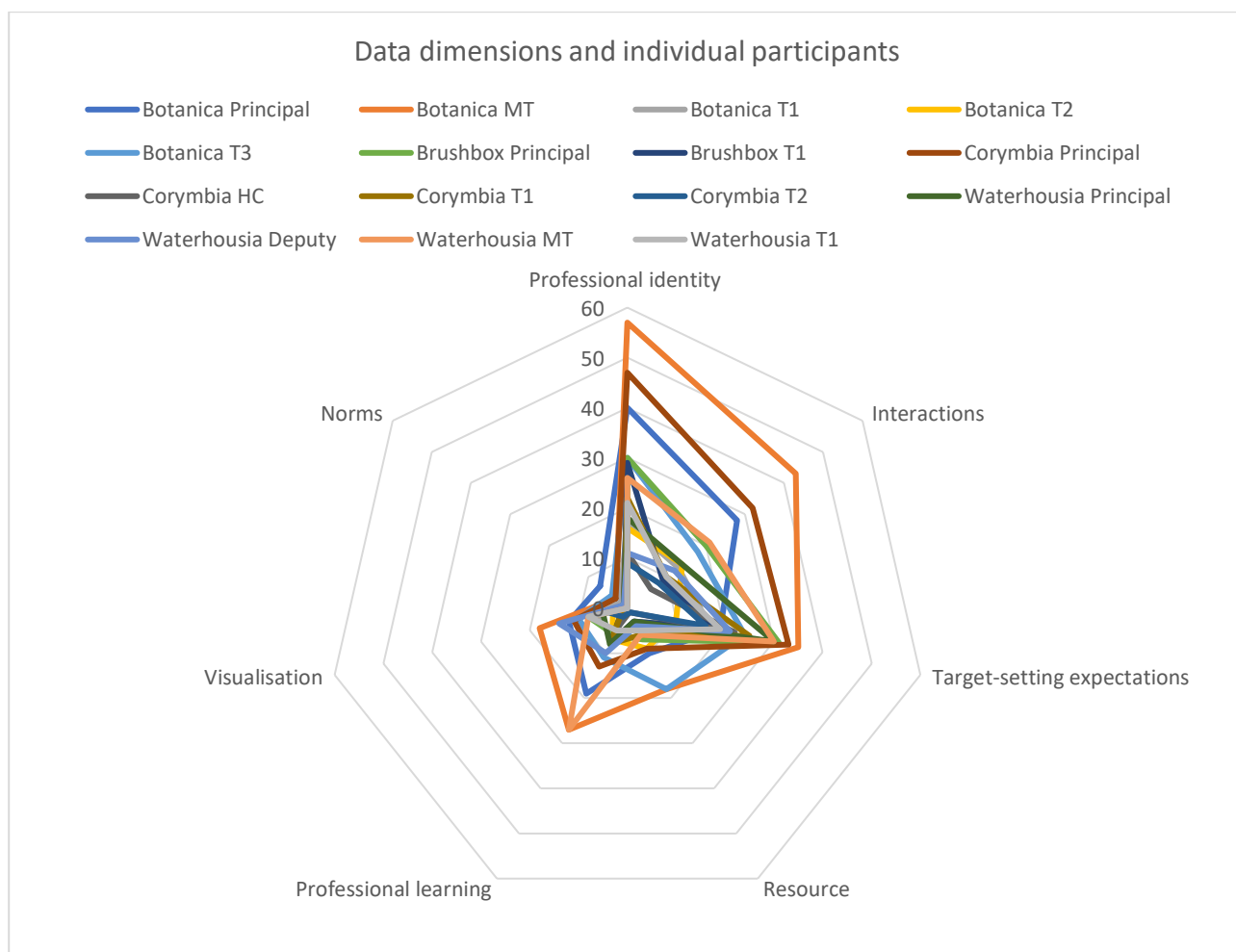
Figure 7.1: Data dimensions across individual participants

To further consider the data according to individual teacher role and responsibility and what position-practice systems they may have to negotiate, data was re-visualised across roles within schools (See Table 7.2 and Figure 7.2).

Here it should be recognised that numbers of participants for each role varied and so any visualisation should be considered with this in mind.

Table 7.2: Data dimensions across roles and responsibilities

Data dimensions	Leadership team (n=5)	MT/Coach (n=3)	Teachers (n=7)
Professional identity	146	94	144
Interactions	106	70	82
Target-setting expectations	134	87	129
Resource	33	25	45
Professional learning	56	58	48
Visualisation	50	27	33
Norms	12	4	9
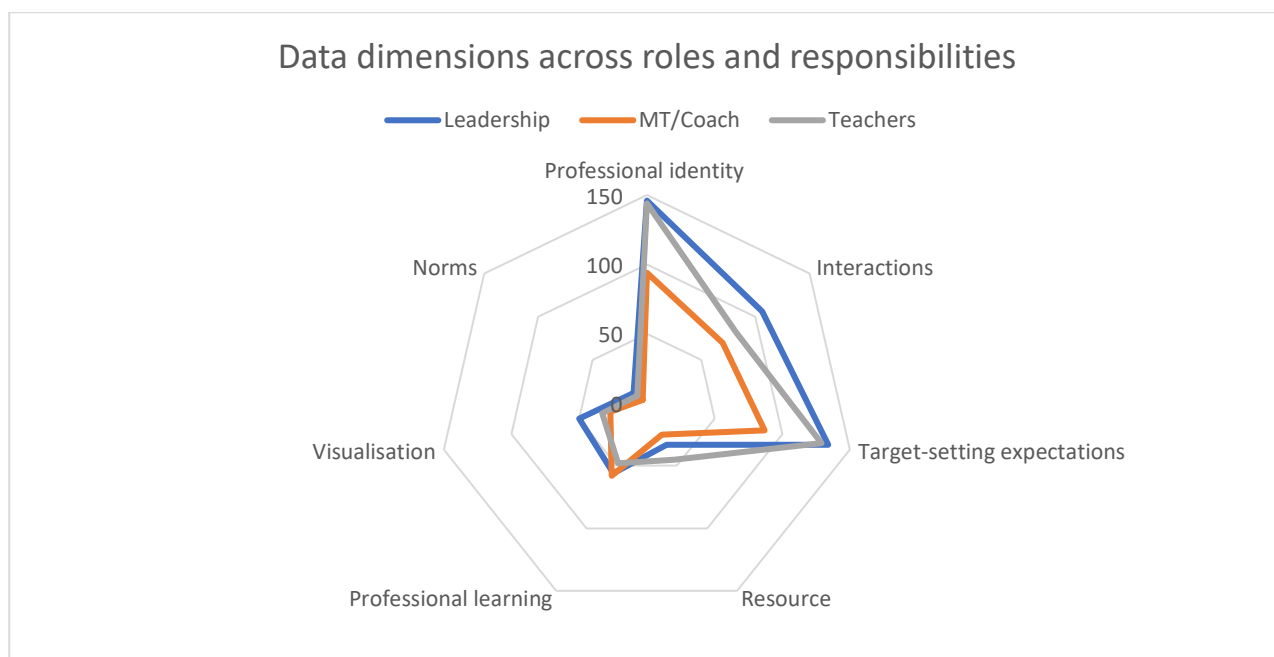
Figure 7.2: Data dimensions across roles and responsibilities

To summarise, three emergent structures, *professional identity, interactions/ communications and target-setting/expectations* were likely to be influential structures when considering how each agent responded to new uses of data in schools. However, the interdependencies of the emergent structures resulted in a complex space as each agent had the opportunity to mediate and negotiate according to their position from within schools. Also, different co-existing agent groups (corporate agents) were likely to be pulling and pushing institutional structures in alternative directions influencing the reshaping of context for individual agents (primary agents) (Archer, 1995). It was also noted that as these conditions were emergent from

previously described co-occurring structures active in other strata, they were unlikely to present as stable relationships (Gable, 2011). How teacher agency was enabled or constrained by the social relations emergent from these structures was therefore dependent upon their situation and context, and the attendant mechanisms influencing these structures. Further analysis of these structures and possible emergent social relations in each case school was necessary.

7.5   **The School Cases**

The original research plan set out to develop a comparative case study of teacher response to new uses of data in four schools. However, in the course of the study, a process of casing and re-casing took place (Carter & Sealey, 2009; Ragin, 2009). Here casing supported the isolation of discrete objects for the research exercise by the act of designating them as cases (Sandelowski, 2011). Researchers "delimit the temporal and spatial boundaries of the case, but those boundaries can change as the study of cases proceeds"; in other words, "cases may be re-cased" (Sandelowski, 2011, p. 155). As a theory-dependent process, casing and re-casing acknowledge the complexity and intensity of reducing research in complex open systems, such as schools, into recognisable objects of knowledge that present the possibility of reduction to single units of analysis.

In seeking mechanisms likely to influence data use at the individual level, the research effort turned to the nature of the relationship each agent had with data. Of the three emergent, yet interdependent, structures that influenced the position-practice systems surrounding data use within each school, individual agent's professional identity and deep relationship with data emerged as most likely to affect the situational logics of agential action. Here the emergent social relations appeared dependent on an agent's possible critical, active or passive engagement with data (its forms, dynamics and infrastructure) and how each "made sense of data as a way of knowing the (school) world" (Milan & Van der Velden, 2016, p.63). Accordingly, the analysis re-focused attention on agency and agential engagement with data. Given that the co-occurring structures of school improvement and data-induced accountability continued to operate within the schools, how agents responded was likely also to be dependent on the degree of structural/cultural influence and the degree of agential freedom present in each interaction (Scott, 2000).

With a further refined scope, it was now possible to develop CM(A)O configurations that tested for the intended outcomes of policy direction and intervention to compare with actual outcomes within each case school. These contrasting CM(A)O configurations provided an opportunity to build a matrix of relationships with the potential to examine causal outcome possibilities. This engagement with the empirical data as visualised in Figure 7.2 captures the complete contextual strata introduced in Chapter 5.
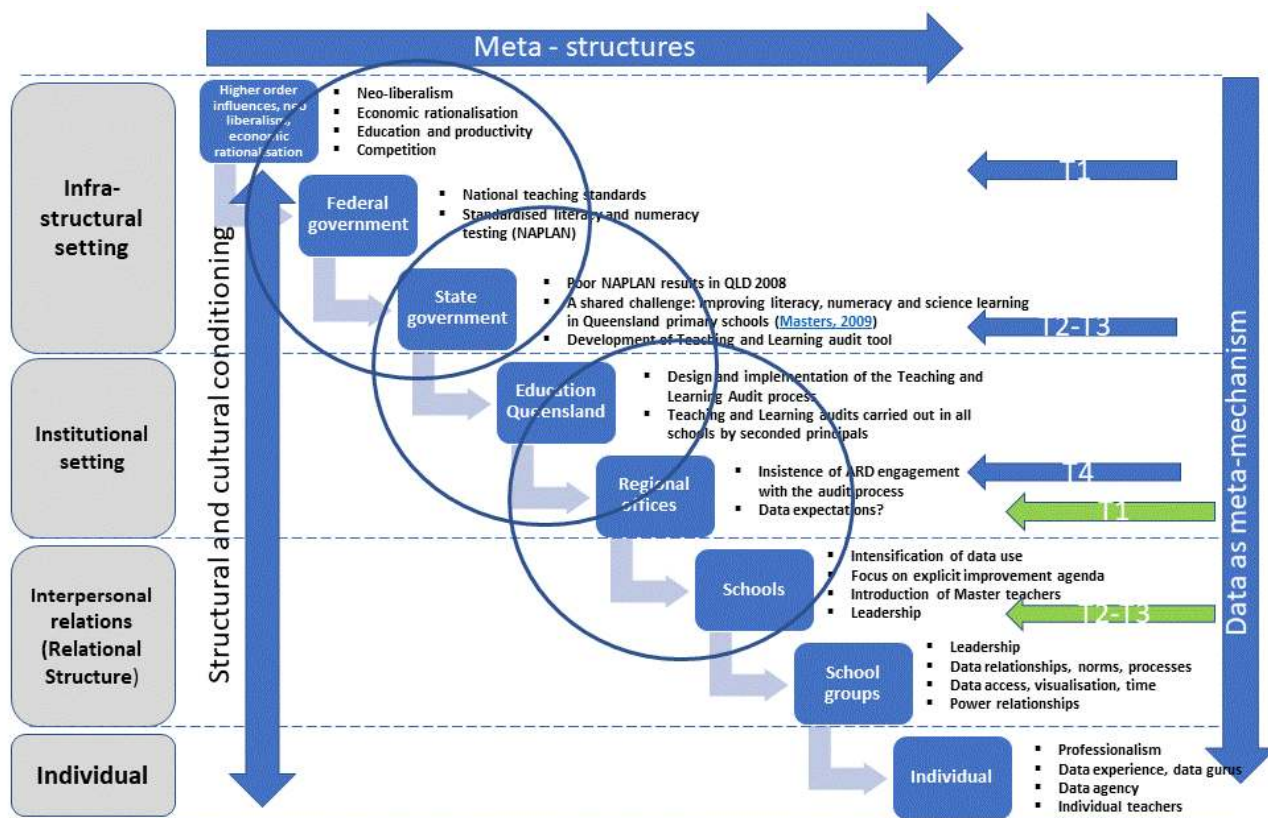
Figure 7.3: Context strata relational-individual setting interaction (adapted from Herepath et al., 2015)

Principal/teacher engagement and interaction with data in each school is described in the next section in preparation for establishing families of CM(A)O configurations in operation across each school.

7.6   Comparing School Cases–Outcomes Within Schools

In the course of analysis, it was noted that principals, master teachers and teachers engaged with data in different ways. Interestingly, this was not consistently dependent upon the role they held or position-practice systems that they operated within and sometimes connected with the individual agent's embrace or resistance of new ways of knowing through the access to more data (datafication). It was noted that principals in small, country schools developed different data approaches to their counterparts in large, urban schools. Subsequently, the initial comparative outcomes for the initiation of CM(A)O configurations were proposed as degrees of *engagement* with data leading to the morphogenesis/stasis of data use. Here, differences in principal/master teacher/teacher response to data and how this affected agential interactions and data routines supported comparison across the four schools. Attention was also drawn to forms of agency and professionalism that were emergent from these interactions. Accordingly, the school cases

presented here are alternative data narratives where this interplay provided a series of options for cross and within-case comparison. Table 7.1 outlines school data, population and settings.

Table 7.3: School data and setting

School [26]	Approximate[27] number of students?	Education Queensland Zone	Approximate ICSEA	Independent Public School (IPS)[28]?
Brushbox State School[29]	40+	Rural	900+	No
Corymbia State School	100+	Rural	1000+	No
Botanica State School	600+	Metropolitan	950+	Yes
Waterhousia State School	800+	Metropolitan	1150+	No

7.6.1   Brushbox State School – We know everything!

According to the principal, Brushbox State School was an *inclusive* school, one that served many students who appeared disenfranchised from the education system. She commented:

> I don't know if it is that other schools don't want them, or the parents don't feel that they're getting serviced as best as they could be … and then they get sent here or they have just about been excluded from other schools and then we take them in. That's what I mean by inclusive (BrSSPr).

The principal was intent on changing behaviours and reintegrating these students into the regular school system. Her approach, grounded in the understanding that real school improvement depended on the "creation of new knowledge for the adults making the decisions" (Earl & Timperley, 2008, p. 2), relied on co-opting the entire staff to the project. This theory of action, while simple in concept was, not surprisingly, complex to enact.

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[26] 2014 Data accessed from MySchool website https://www.myschool.edu.au/

[27] Numbers are approximate given the identifiable nature of the actual numbers via websites.

[28] "IPS partner with their school community to create and pursue a shared strategic direction that focuses on student wellbeing and improved student outcomes. IPS operate under the same legislation, industrial instruments, directives, whole of government policy and national agreements as all other state schools. IPS are high potential schools with some operational flexibility to test new ways of working. It comes with an expectation that they will be fully accountable to their community and the department and share innovative practice that lifts the performance of their own school and supports positive change across the entire state schooling system" (DET, 2013, p.1).

[29] All school names are pseudonyms (native Australian tree species).

The central premises of this process relied, firstly, on the collection of formal/informal evidence and, secondly, engaging in productive conversations about that evidence for the purpose of improvement. However, the principal's focus was less on performance data and more on behaviour, attendance data, and the informal data collected by the staff (including teacher aides) in the classroom and playground. The principal articulated this close working relationship between staff and data:

> My thing is that the teacher aides really need to work very closely with the teachers and they're not just a teacher aide, they are an integral part of the teaching team. If somebody is away, we notice it and if they're replaced by somebody who is not in with the team, then we notice it. So, I'm losing someone on my team and I'm struggling to replace them because of their knowledge about the kids (BrSSPr).

The principal appeared to have transformed her staff from primary agents (passive with limited power to change society except via demographic numbers) to hold a form of corporate agency (active through coordinated action). This agency drew on a powerful set of cultural ideas which operated at the school level, conditioning the agents to act in a certain way. Here similar interests drew upon configurations of complementary ideas, which provided the group with more resources (data and influence). This, in turn, increased the power of the staff and allowed them more control in their work environment. Consequently, staff had the prospect and option to change the nature and understanding of their work, using access to and interaction with data as the catalyst.

The small size and the community focus of the school facilitated relationships and extended the day-to-day dealings between the principal and staff. This emerging social relation ensured a considerable amount of interaction and communication around the implementation of the curriculum and the undertaking of administration tasks between staff members. However, primarily, the interaction was about the students in the school. The principal describes the dynamics of the school in this way:

> I don't think the conversations are better because we have more data. I think the conversations are better because we are working as a team. I mean the data is there and you can analyse it but unless you have got everybody on board talking the same language about the same person, then it is not as effective as when you get the observations coming through. For example, when a student is not performing, a teacher aide might notice something during small group work, and then the teacher might say, well I observed this and then a third person might talk about something that occurred in the playground. All this evidence is then used during a professional

conversation with the primary goal of improving the individual student's learning through direct action (BrSSPr).

The careful monitoring of progress and performance through collection, recording and analysis of data, both informal and formal, was the fundamental process driving school improvement practices. This is what Coburn and Turner (2011b) argue is an interpretative process that involves three stages: noticing the data; making meaning from the data, and constructing implications for action from the data. This interactive process is also influenced by the people involved and the dynamics of the social relations, which may ultimately lead to action or inaction. Again, as Archer (1995) maintains, these social relations as mechanisms have causal powers which may or may not be activated. These tendential powers rely on contextual factors, particularly those situations where corporate agents are operating and interacting, to generate emergent properties. In the case of Brushbox, the increased interaction between all levels of staff around the processes of data use was described by one of the teachers as:

> We know everything. Nothing escapes anybody and everybody knows it. There are those things that slip by; however, they are then brought up in staff meetings. Generally, we know, and we pass it on as we pass each other on the way in, on the way out. There are only a small group of us. Yes, we do, we talk… (BrSST1)

These types of evidence-based conversations did not ignore the minutiae of daily school and home life and were essential to the school. However, as Coburn and Turner (2011b) argue noticing data is only the first step; it is what occurs after that is crucial.

There are numerous pitfalls to avoid in data use processes. Earl and Timperley (2008) maintain that: "Transforming data to usable evidence and knowledge for educational improvement requires engagement in technical and inter-personal processes" (p. 121). The complexities of these processes can often be ignored and with the subsequent outcome—a fragmented approach to data use. A teacher interviewed provided a hierarchy of data collection and use that resonated with her:

> "Good data" for me is what helps the kids in my class, providing the extra support, letting me know when they have got it. "Ok data" is providing extra support from outside agencies, and "bad data" is the collection of data that is overkill. Probably the data that is primarily collected for accountability purposes… is in this category (BrSST1).

This echoes the principal's understanding of some external data collection practices as potentially "useless" because it took months for the results to be returned to the school. She

preferred the more immediate processes that were school-based and initiated. It was this data that informed much of the school-based processes around data collection and use. It was also the routines that evolved around the use of data that were particularly important, the configuration of people, with similar sets of beliefs, who gathered to interpret the data and decide how to act on it (Coburn & Turner, 2011b). The multilevel staff meetings ensured that different perspectives were potentially available and more importantly, recognised as valuable.

What does emerge from this interaction as the school group constructs implications for action from the data (Coburn & Turner, 2011b) is a series of decisions that appear to have driven the school into the next phase of school improvement. These decisions and the subsequent actions associated were the outcome of "productive evidence-informed conversations" (Earl & Timperley, 2008, p. 3) and were often taken in consultation with other interest groups. Evidence suggests that developing strategic relationships with other corporate agents within the larger regional domain that successfully promoted the school agenda of inclusive education were integral to the data for improvement process. The principal observed:

> We have access to the mobile guidance officer based in town, we have the Heads of Special Education, who we don't see very often even though we need to. We also access private educational support services that come out and do early identification of students with needs. We work with them to develop profiles prior to the students reaching Year 1. We build the profiles in Prep and the parents are highly involved, we communicate regularly and then in the first week of Year 1, all the papers are signed, and we can access more resources to assist the students with special needs (BrSSPr).

To this point, the discussion has focused on the relationships engendered by and within the school space giving the appearance of the school existing and acting autonomously. However, the principal makes it clear that the school still functioned within and was subject to the wider social structures in place.

> We are just reviewing all that now because the curriculum has shifted, so we need to change what we are doing and what data we are collecting to fit in with the new regional benchmarks. We get a data expectation set from regional office which is the regional benchmarks and then we set up our review cycles to match when their data collection processes are … and what they want (BrSSPr).

As is the case here, previous research on data use suggests that different levels of authority influence different levels and implications of data use (Coburn & Turner, 2011b). Spillane (2012) more specifically acknowledges that the power and professional identity associated with authority positions (e.g., regional officers, principal and teachers) are "produced, reproduced, and sometimes renegotiated in the performance of organizational routines" (p. 132). The semi-autonomous state of the school is a balancing act for the principal and staff whereupon they must negotiate their way through a multi-layered, organisational, and political context (Coburn & Turner, 2011b). At each point in time, there were different cultural, structural and agential influences at work that promoted specific outcomes.

The principal operating between two position-practice systems engendered by the structural emergent properties transforms the way the school operated through social interaction with the staff. In establishing the collection and analysis of formal and informal data as the norm for every staff member, and by allowing access to all data for everyone, including the teacher aides, the principal has in effect increased access to resources (data). In doing so, she has increased the bargaining power of the staff, affecting a shift from primary to corporate agent status. Here the achievement of teacher/aide agency has been enabled through the actions of the principal as a social actor.

7.6.2   Corymbia State School – The Corymbia Way

The Corymbia principal had been in place for many years and, unsurprisingly, advocated "consistency and continuity of practice" as foundations of his school ethos. There was a strong culture of community and school expectations which was manifested in "The Corymbia Way", a set of beliefs that were embedded in the school documents, communications and signage across the school. According to the principal (and similar to Brushbox), Corymbia as a small community school worked best as a team. He commented:

> We have staff meetings that are part-management and part-curriculum development
> and so we tend to work together most of the time… the buzz words are professional
> learning communities but you know … small schools work that way anyway… as
> professional learning communities…small schools have to work that way for people
> to progress and to get things done … and so you tend to work as a team more often
> than not (CoSSPr).

The community character of the school combined with the small size ensured that working relationships existed across the staff on all levels. The experienced teachers enjoyed a large degree of autonomy, and this was something the principal confirmed—that he trusted his teachers to get on with the job and achieve the appropriate results. The principal had developed a pragmatic approach

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to the new demands placed on his staff and school by various external operational structures manifested as data expectations and school improvement policies. He stated: "We value data, but it has got to be relevant and that's one of the things in our region, it has to be the purposeful use of data. If there is no purpose, then it's a waste of time". He goes on and elaborates further:

> Small schools are different from other larger schools, you still have your flexibility so I guess maybe like I see myself as a bit of a *filter*, you protect the staff from some of the stuff that they may not need to do … because what matters is what they do in front of those kids every day and they work a damn hard long day…and if you are going to expect somebody to do something else then you have to have a good reason (CoSSPr).

Like the principal of Brushbox, purpose and relevance pervaded the principal's understanding of his leadership role and his engagement with data. Moreover, while he had produced a series of data use protocols and processes, these appeared primarily for the purpose of appearances, whereby he engaged in a 'performance' designed to meet external data expectations and accountabilities set by his supervisor (Ball, 2000; Ball, 2003).

The principal indicated that data from NAPLAN was useful only in that "it confirmed what we already knew as a school". It became clear during the conversation that these data were the drivers only to the extent they allowed an analysis of school requirements. The principal expanded on this:

> [NAPLAN] gave me as the principal of the school confidence in that this is what the data are showing us and the teachers see it. I guess as long as I and they can see that there is relevance in doing something then we will … so we try to have a bit of flexibility in the small schools… we just can't do everything. This sort of data gives you structure, and the teachers can see this is where we are heading… so processes and a common language …you know the purposeful use of data. But you know I can't bear doing something that is not relevant (CoSSPr).

As was the case at Brushbox, the principal was used to setting his own program and despite the increase in structural reform and the new powers given to regional offices in recent years (Bloxham, 2013; Bloxham et al., 2014; Gable & Lingard, 2015), he made the decisions in the school. The principal, as gate-keeper of the data sets, became the filter, setting the school improvement agenda, deciding what data was relevant and who got access to what data (Coburn & Turner, 2011b). He was also responsible for setting the norms of interaction, the levels at which

teachers interacted with each other and himself about the sharing of practice and evidence of student learning. He had this to say:

> We are in the relationship business and if you can't establish good relationships with people then you shouldn't be a principal…no matter how good you are crunching data and developing programs or whatever, if you can't communicate with people, if you don't show some respect to others then you are doing the wrong job (CoSSPr).

This is in contrast with other situations he perceives in the region where he believes:

> That sometimes people get driven by what the system wants, they don't allow enough time for the people they are working with. There are a lot of unhappy people out there working in schools because the whips just crack…because the whips crack from above them…so there are layers of demand and the pressure to show improvement is pretty stiff (CoSSPr).

The principal was required to negotiate the position-practice systems that leadership-driven school improvement and data-induced accountability structures had engendered; however, he also had recourse to an agency that resisted some of these external policies. His assumed role as a 'filter' of these emergent properties, in turn, shaped a context that supported the development of agency within his teachers. By acknowledging the professional expertise of his staff and noting the importance of the environment in promoting quality teaching, he supported each teacher's broader, contextually mediated competence to use data appropriately (Priestley et al., 2015b). In short, teachers were able to choose between different options and make decisions according to their own data understanding and judgment in any given situation and context. Here, this agential freedom is not conflated with autonomy in that the principal still supported patterns and routines that produced goals and enhanced individual teacher capability (Priestley et al., 2015b; Priestley, Robinson, & Biesta, 2012). Teacher professionalism was supported in a relational environment that sustained teachers' own data belief systems and promoted improved student outcomes.

The principal acknowledged his relative power compared with that of the primacy of the power of the local, regional office driving school-improvement policies. In other words, while the principal was supplied with reasons to change the way he managed the school, he elected to engage in a form of decoupling, where his engagement with new data expectations promoted by the Regional Office could be considered superficial, and in places ceremonial at best (Bromley & Powell, 2012). There is little change to how the school operates from day-to-day despite policy

directives that promote other data practices (Gable & Lingard, 2015). The outcome of these decoupling strategies is that it appeared to remain 'business as usual' at Corymbia.

There were two distinct modes of interaction around data use situated externally and internally to the school. Central to these was the emergence of the principal as social actor, as he negotiated with both the local, regional office and his staff. In the first instance, this took the form of a rather defensive (in morphogenetic terms) mode of interaction that the principal employed when dealing with the ARD. The principal saw himself as a 'filter' between the structural demands of the various interventions and the ideational drivers of the day-to-day running of the school. In the second instance, the principal adopted a more strategic approach that established an environment supporting the developing of teacher agency and extending teacher professionalism. In both cases, the principal controlled the distributions of resources (data), courtesy of the "relatively autonomous powers of constraint and enablement which are lodged in the role" (Archer, 1995, p. 276). Suffice to say, being a long-serving occupant of the role ensured that the principal had acquired enduring powers capable of establishing norms of interaction around data as part of "the way we do things" at this school (Coburn & Turner, 2011b, p. 184).

In order to provide an explanation of the outcomes at Corymbia, consider the perception that underpins the intervention of data collection and analysis, which is that actors and agents believe that the use of data can act as "an ideational and structural stimulus that might promote an increase in both structural and social complementarities within the organisation" (Horrocks, 2006, p. 195), consequently improving school outcomes. In practice, the structural interests of incompatibilities emergent from the interaction between the regional office and the school ensured a situational logic of compromise, whereby both parties must decide to accept some losses and make some gains (Case, 2013). In other words, while the principal had to negotiate carefully with the ARD around targets and outputs from his school, he also had the autonomy to make decisions as to how these policies were enacted and the extent, they influenced the staff within the school. As previously discussed, at the school level, a different cultural interest was significant. From a configuration of complementarities, a situational logic of opportunity arose, which meant that staff had the option to engage in new practices around data use and analysis. Whether or not they did, remained a personal and professional choice. The principal provides an example of this professional respect:

> Yes… well we are professionals and I have professional conversations with the staff, but you know…the Year 1 teacher, she's in her 60's, has been here for twenty odd years, I defy anyone to be a better year one teacher. I'm not going to insult her

intelligence by sitting down with her saying "Now Janet, let's talk about how you are using data…" (CoSSPr).

7.6.3 Botanica State School – A "Putting Faces on the Data" school

As an Independent Public School[30] (IPS), Botanica had the brief to trial innovative ways of working with data which might lead to real school improvement. There was also the imperative to provide and share a strong evidential base about the measures and interventions with other schools (DET, 2013). Being an IPS, the principal also had a great deal of autonomy. This included relocating funding to areas of priority, one of which for Botanica was data collection and analysis (designated as one of the school's *rocks* for improvement). This combined with the principal's understanding that the school was a "Lynn Sharratt" school[31], a school which subscribed to the ethos of every student as an individual, with a FACE. To do this, Sharratt and Fullan (2012) assert "you need data, but you need to generate and use it in a way that makes the child come alive in the minds and actions of teachers" (p. 3).

Collectively, the Botanica leadership team endorsed Sharratt and Fullan's (2012) 14 parameters designed to increase students' achievement. From these key areas emerged the case management approach, the strategies of which included data walls and case-by-case meetings, reimagined at Botanica as data conversations. The principal created a role to facilitate these one-to-one data talks with teachers, which in turn coincided with the advent of the Master Teacher (MT) program. She explained:

> EQ brought in MTs which is very much about a data coaching role with the teachers, talking to them about their data… because it is all very well to tell people to "do" data, to tell teachers to work with their data but you need to have conversations and they need to be comfortable. They needed to know how to access and utilise it. There were different levels of data experience. Some people have been in schools where it was embedded and then there were some people who have been here for 20 years and have never used it in this way. So, it had to be a very facilitated, structured and supported move process (BoSSPr).

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[30] IPS promote system-wide improvement by trialling and sharing good practice across the state system. They have a degree of freedom to innovate and are accountable to both community and government.

[31] A copy of *Putting FACES on the data: What great leaders do!* was distributed to every school principal at the annual State School Principals Conference held in May 2015. The principal had, in turn, bought and distributed a copy to everyone on her staff.

The MT completed a leadership team, who then took the collective role of interacting with the staff on a regular one-to-one basis with individual data for each student in every class. In Archerian terms, this group acted in several ways. Firstly, it can be named as a corporate agent because of its potential to maintain or change the way the school operated around data. Secondly, it was tasked with the role of promoting the data-use philosophies that were emergent from several ideational sources, chiefly the Sharratt and Fullan text. And finally, it was an important conduit for interacting with groups, both internal and external to the school.

In addition to the primary managerial roles assigned to each member of the leadership team, they also had pivotal roles in the data routines developed within the school. The MT was key to this interaction and for clarity sake, the following section discusses his modes of interaction with the staff. One of his initial tasks was to create a "data book" for each class, which involved taking some basic assessment results, including NAPLAN and breaking them down into easily accessible graphs and tables. The re-visualised data were then presented back to the staff in a whole staff meeting to discuss. The MT observed:

> Some people were very sceptical about the NAPLAN results; however, when you triangulate with the school data, then it was hard for them to argue (with the data). There is always the temptation to just tell them. However, there needs to be ownership and we are really trying to build capacity within the staff and the biggest thing to point out was that it wasn't a blame game. And that's pretty hard to convey because people are naturally defensive, and when half our kids are failing…clearly there is a need and that's really powerful, you can't argue with the numbers (BoSSMT).

Following the school meeting, the MT met on a one-to-one basis with teachers in the school to speak about students on an individual basis. Other learning specialists might join this conversation; however, the focus was on the MT and the teacher. This interaction did not include the principal. This omission was a deliberate attempt to remove the "perceived" element of surveillance which may or not have been present in the conversation. The outcome being an "environment of trust" suggests the MT.

The success of these strategies was largely determined by the views and beliefs of the individual teacher, the nature and length of their experience and their level of engagement with data and expertise in the utility of data (Henman & Gable, 2015). The previous conditioning and shaping of the individual determined the situational logics at hand, and consequently, how successfully the

interactions about data collection and analysis with the staff were perceived. A teacher with 35 years' experience considered the data processes in a pragmatic way. She commented:

> You know how well the kids are reading, it's in your head and then you have one test which supports the ideas in your head…which is good…then you have to collect other data and I then think that this is a piece of data I don't need for me, I need to do it for someone else…(BoSST1)

This was not strongly articulated resistance and any response to new demands for data was typically muted. There were always other courses of action available to the individual teacher pending their own understanding of these data interactions in the school space. An experienced teacher with a different perspective suggested:

> I think we get kind of sceptical about the use of data, in that we get on the back foot and think that it's going to be used against us, as far as performance review and all this sort of stuff. But being a logical, mathematical thinker, myself, I understand the use of all this data and where it's going to take us, with our teaching. In this school, we are using it more as a tool for quality conversation, targeting obviously where we need to go (BoSST2).

Despite some resistance, the data collection and analysis interactions implemented appeared to shape the school staff's understanding of data use. This staff alignment appeared beneficial. As one experienced teacher commented:

> You can say "As a school, this is what we are doing with our data. This is how we are trying to meet your students' needs. We can't possibly have a one-size-fits-all because every student is different." And if parents understand that there are data, it is in place, and it is driving the school to improve, I think the whole stigma surrounding it is going to change in the next five/ten years, and people won't feel so threatened by it (BoSST2).

"Purposeful data and purposeful use of data" was the mantra at Botanica shaping the situations in which the teachers found themselves. These influences supplied good reasons for particular courses of action that were mostly adopted, with few, if any, choosing to test what the negative impact of ignoring them might be (Archer, 1995). Interestingly, even while these structural and ideational influences were at work, the teaching staff group found there were still different courses of strategic action open to them. One of the prep teachers noted:

We kind of decided as a team. It's the second year that we had done it (the assessment) and we had all let it drop away. Luckily, the principal backs us up on this; that is if it is not purposeful, if it is not effective, useful, kind of collecting of data…we're going to have to talk about it again and ask the question, "Do we have to do it next year? Is there another, better way that we could do it?" (BoSST3).

It appeared that while the leadership team, as corporate agents, held most of the bargaining power and negotiating strength in relation to these data interactions with the staff, there was still potential for conditioning through exchange transactions. As noted in Chapter 3, Archer stresses "that all transactions, as processes of exchange and power, involve the use of resources, namely political sanctions, liquid assets and expertise" (1995, p. 297). In this case, what this teaching group might have lacked in the former two, they did, however, have the resource of expertise in data collection at the prep level, something the leadership team recognised and respected. This serves as a reminder that any strategic course of action is never solely conditioned by corporate agency, and that primary agents still have the opportunity to mediate outcomes, enabling forms of agency.

A further mechanism for data usage that emerged from the adoption of the Sharratt and Fullan (2012) text was the data wall. The recording of students' achievement data is not new. However, the wholesale visualisation of entire cohorts is. Data walls advocated by a number of other education theorists, (Earl, 2008; Earl & Katz, 2006) are more widely used as a mechanism to draw teachers into conversation about students. They "create visuals of all students' progress and provide a forum for rich conversation among teachers" (Sharratt & Fullan, 2012, p. 593). The data wall at Botanica was in nascent form; however, approbation from the principal and the other teachers indicated it had potential to grow in influence and the MT had already signalled the purchase of a transportable style data wall that could be moved from place to place (and closed when not required). The principal made this observation about data walls:

We really like them, they are really…. they are really in your face and it is very confronting to see who those little ones are. It's confronting to walk in there and see who is still down at the bottom and yes …their names are right in your face (BoSSPr).

The MT whose task it was to develop the data wall, saw the process a little more problematically:

There needs to be ownership and what we are trying to do is build capacity in the

staff to look at themselves and you know everyone says "Gil's data wall"[32] but it's

their data, not mine…it's really hard to break that thought process because it is in my

office (BoSSMT).

The activities associated with the data wall had the potential to provide both alignment of purpose within the school and yet could still be seen as someone else's problem depending on whose perspective it was seen from.

I probably don't see it very often, but Gil looks at it all the time and goes, "Oh these

kids aren't moving" (BoSST3).

Gil does a fantastic job with these data walls and stuff. I'm a visual learner as well.

And seeing these data walls I go great. "Okay there are gaps. These students need to

be moved forward. Let's get some professional dialogue happening" (BoSST2).

Drawing attention to the impact of the data wall provides insight into staff mediation of the different data use interactions for school improvement measures being implemented within the school. As Archer reminds us, "people are capable of resisting, repudiating, suspending or circumventing structural and cultural tendencies in ways that are unpredictable" (1995, p. 195). In other words, while some primary agents sought to align themselves with the leadership team in their role as corporate agent, others chose to see the processes as removed from their own classroom, their own situation and opted for a form of (silent) resistance.

While the ideational standing of the Sharratt and Fullan text appeared largely static, there was good news to be had from the acceptance of the role of MT position. It was the one-to-one engagement between the MT and individual teachers around individual students' data, that had resonated in the school. One teacher described the advantages of working with the MT:

I guess it is making me appreciate that data is another thing to add to other things that

help you improve your teaching. I think with data I use it more as a way to kind of

confirm. So, I guess with my meeting that I had recently with the MT, I had ideas

about my kids, what we needed to work on, where I needed to go already; from my

observations, working with the kids. And then looking at the data, helped me

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[32] All names are pseudonyms.

confirm, what I already knew; or, yeah, helped me identify areas where I had not perceived there were problems (BoSST3).

The leadership team, through the MT position, could influence the relations and transactions between different interest groups in the school. The gradual ideational reshaping of the staff emerged from a set of designed routines built around the interaction of the MT, individual teachers and individual sets of classroom data. These designed routines appeared causally significant, shifting the staff mode of interaction from a defensive to a concessionary mode of working with data. The outcome of this was, the nature of exchange transactions and social relations between the groups altered (Archer, 1995). The teaching staff's actions and interests became more aligned with the leadership team's data-use strategies; in return, they received more resources in the form of extended teacher aide hours and other support mechanisms.

As Coburn and Turner (2011b) remind us, data use is a social process that takes place in social interaction and negotiation with colleagues. As such, the patterns of interaction are important at both an individual level and within a group. What sets the Botanica context apart is the intensive and extensive interaction on a one-to-one basis the MT had with individual staff members. This concentrated and systematic building of social relations around data use was a characteristic of the changes being implemented at a foundational level within the school. As previously discussed, data interactions shaped as one-to-one data talks were carried out on a semester basis. The MT described the rationale:

> As a direction of the school…teachers know we are looking at every student. I mean as a team…they know…and that we need to be thinking about every student and if they are not improving…then why not…and then what are you doing about it? (BoSSMT)

This process followed whole school engagement with large and small data sets at the beginning of each semester. To avoid reproducing the present circumstances, the configuration of structural interests—necessary incompatibilities—which created a situational logic of compromise, whereby the leadership team's (corporate agent) actions had the potential to enact changes in the way the staff (primary agents) functioned, albeit only if they could convince the staff that it was in their best interests to change the way they collected and utilised data in the classroom. At this point, at least three good reasons were supplied. The first, in the form of an ideationally influential text "Putting Faces on the Data", was provided to every staff member. The second, the promise of extra human resources came as a full-time teacher aide shared between two classrooms. The third, extra

professional development around data analysis provided by the MT and other members of the leadership team. Archer (1995) argues that:

> Since all methods for promoting change or protecting stability, depend upon the use of resources, then their distribution is of the greatest importance since it/they govern who has access to them and can participate in these processes. The differential availability of different resources to various agents is thus the bedrock of bargaining power.
>
> (pp. 297-298)

These interventions, in the form of resources did not consider the potential sanctions that might also be enacted in response to non-compliance within the staff.

7.6.4   Waterhousia State School – An explicit improvement agenda

The principal of Waterhousia supported a very explicit improvement agenda in the school which he believed was important to meet the expectations of Education Queensland. He was at ease under the system of institutional relationships which allowed him, as a social actor, to take the lead in defining the aims and objectives of the school. He was, however, conscious of the need to meet the requirements of the next tier of governance above; this was apparent when he commented:

> I still think any good system looks beyond its own borders and comes up with strategies that suit it and I'm kind of hoping that the School Improvement Unit (SIU) or the reviews give people like me a very clear understanding of where I can go from here. I think that if you are seeking continuous improvement then sometimes in life you don't know what you are not doing, so it is good that independent eyes can come in and look at your practice… as long as you don't take it as a criticism (WaSSPr).

His view differed from the other principals in the study, in that he appeared more attentive to these external structural influences. The principal recognised the extent that the director of the regional office was now "accountable for all the schools in the region" and "how he deals with how the agenda should progress is up to him". This acknowledgement of the external power relations was most influential in the improvement systems in place in the school. More so than the other school principals, Waterhousia's principal fostered "a sense of urgency" around the improvement agenda. This understanding suggests the dominant position of the external corporate agents of Education Queensland and the office of the Assistant and Regional Director. The rise of influence of external vested interest groups is hinted at by the more overt surveillance and accountability

practices suggested by the principal (Bloxham, Ehrich, & Iyer, 2015). This, in turn, was conditioning and shaping the environment in which the teachers were operating at the time.

Year-long cycles of leadership-driven school improvement strategies were implemented across the school. These included a series of data-use routines that were established and played a significant role in how the process of data use expanded (Coburn & Turner, 2011b). The first phase of this process involved the principal speaking to each of the year level staff cohorts about the school's NAPLAN results. Here he describes the rationale for the process:

> So I sit with the prep teachers and it's a Monday morning at 7:30am and I share the data from the NAPLAN and I talk to them how they have contributed to the overall results, the big picture, and the trends that we are seeing. The next day I do it with the year ones and so on, so that when we come back as a whole staff sometime in the following month, they are all aware of the trends. They all understand the direction we need to take so when I then say to them we need to focus on spelling, they have a clear understanding of why I have made that statement and then we talk about how we are going to make that happen (WaSSPr).

The data for these interactions were drawn from the OneSchool[33] dashboard and then revisualised for each cohort. The principal took responsibility for the selection of data used and how it was presented to each cohort. Coburn and Turner (2011b) remind us that this availability of data is subject to two elements. Firstly, different timeframes mean when the data is available to different members of staff is determined by who has access to the technological infrastructure. A corollary of this access is also the element of choice, as is who gets to see the data, and in what form will it be presented. Secondly, on the human side of things, the flow of information is influenced by the different connections between staff members and indeed, who are perceived to 'own' the data. The access to and control of this data increased the bargaining power and negotiating strength of the principal and his administration team. However, this group recognised that if they were to promote

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[33] "OneSchool is an Education Queensland software suite that schools use to run safe, secure, sustainable and consistent reporting and administrative processes.
OneSchool supports teachers, administrators and students in:
- student management
- curriculum and assessment management
- finance and asset management
- resource management
- performance, reporting and analysis.
Each Queensland state school student has a secure profile within OneSchool. Individual student information is used by the school to meet its duty of care to all students, and to administer and plan for providing appropriate education and support services" (from Department of Education, 2018, p. 1).

their agenda for data use and change, they would need to further develop existing relations with the staff in the school. Consequently, the initial interaction between principal and year level cohorts was only the first phase of a complex web of interactions around data.

In an initial step, teachers who were confident in their use of OneSchool and data were teamed with teachers with fewer skills in this area. This was perceived to be a less threatening mode of interaction to begin the process. As one deputy explained it:

> We thought it would help not having admin standing over them. And it certainly has helped a lot of teachers work with the data. However, there were still teachers who were resistant. They weren't using it in their planning; they weren't using it how they should have been (WaSSDP1).

The leadership team recognised that further interventions were necessary to promote the use of data in the classroom. A deputy principal described the strategy and the pedagogy informing the process:

> We are taking it like baby steps; and we are calling it "feedback". It's about giving feedback to the students; but it's taking the targeted teachers right back to their initial planning and it's making them look at what the assessment will be, how they can plan for that and how they have to focus on the data (WaSSDP1).

The initial responsibility for this was given to the newly appointed Master Teacher (MT) who described her role as one of coach. She understood her position was about forming relationships between the staff and data. These data relationships were the basis of her success and she was certain about the division between the leadership team role and her own. She explained:

> I had already been teaching at the school and had developed relationships with people, now with my position as part of the admin team I say to them "What we do and what happens within our conversations and when I observe you it stays with me and you. And I don't talk about it with the admin". They (the admin) have separate data meetings and conversations with the teachers (WaSSMT).

In addition to this emergent social relation between the MT and individual teachers, the three deputies had a *data conversation* with each teacher, four times a year. This intensive program of interaction was built on several assumptions around what was appropriate data and how best to use it. Each year-level teacher had several data requirements that had to be met and entered into

OneSchool. From this, a set of end-of-year targets and expectations were tracked during the year. The deputy principal detailed the type of conversation built around spelling targets:

> To make sure the teachers were aware of those I would say to them, "I want you to look at what the end of year target is and to see whether or not you think this child is tracking in these terms". I met them on a term basis and each time they could say whether they were on target and if each individual student was tracking ok. I ask them "Are they on target? We, again, have targets that we have for our teachers; targets involving data. We have end of year targets (WaSSDP1).

These interactions extended to the deputy principals observing classes and asking individual students if the individual planned program was being enacted. This additional student interaction operated in two ways. While it provided the deputy with a supplementary understanding of the student's individual progress, it also served as a mechanism of surveillance that possibly challenged the teacher's autonomy in the classroom. The practice of class observation was introduced over a period of 18 months and it was instigated by the principal. He explained:

> We have an explicit focus on pedagogy, and we can't be talking about that unless we actually know the practice of the teachers…so that observation has to be part of what we do. So, you can imagine a workforce that was not used to people coming and looking at their lessons. That was work we did over 18 months leading in to how it would look and what we would do when we were in the class (WaSSPr).

What emerged from this class observation program and the judicious use of data was the capacity for the leadership team to have conversations with teachers that had "a clear purpose, with the interpretation of the data focused on that purpose" (Timperley, 2008, p. 73). This focused use of data was predicated on the necessity for the data to be discussed and interpreted rather than just allowing it to 'exist' in itself without examination and insight (Timperley, 2008). These concentrated and structured data conversations and interventions on several different levels were evidence of a systematic endeavour to ensure the morphogenesis of data use in the school.

To ensure that the explicit school improvement agenda was successful, the leadership team had to shift the staff's understanding of data use. To accomplish this "ideational unification" (Archer, 1995, p. 234) the leadership team adopted the data-use routines, which resulted in the intensive set of social relations apparent in the school. The relative power and ideational standing of the leadership team combined with their position as corporate agents were perceived to be enough

to ensure that over a period, a shift in the culture of data use would become apparent. The MT observed:

> So, the message we say to this group is the same that we say to that group. It is not a "if you want to do it you can do it; and if you don't, you don't". No, I'm not about that because I think it sends mixed messages, and that allows people who think "this is the way I've always done it, I can keep doing it like that" whether it is good, bad or otherwise. If you want to impact on the school and make change, it has to be a whole school approach (WaSSMT).

While the staff always had the potential to not engage with the new practices of data use, the leadership were able to supply good reasons for them to do so. As previously discussed, while agents shape the situation they are in, "the shaping of the situation also includes strategic guidance" (Archer, 1995, p. 216) as to which course of action to follow. In the Waterhousia case, the leadership team attempted to share the resource of data through professional development and peer-to-peer interaction, to begin with. While this was successful for some teachers, others were not so easily shifted. The deputy commented on some teachers' engagement with data:

> They didn't use it; they didn't incorporate it or maybe they didn't even trust it (WaSSDP1).

These data conversations signified an opportunity for the leadership team to engage in intense social interaction designed to act as a 'catalyst' for the ideational and expansive reshaping of data use within the teaching staff. The external structural emergent properties and their associated causal powers afforded by school review processes and the ARD's strategic interaction around data with the principal served as the impetus for the leadership team to become increasingly focused on an explicit school improvement agenda. This pressurised environment legitimised the leadership team's access to classrooms for observations and the opportunity to perhaps apply "sanctions" in the form of increased surveillance in classrooms and reduced autonomy for teachers. The reasoning applied here suggests the stringent constraints schools such as Waterhousia might come up against (Willmott, 2002). In the case of Waterhousia, these constraints are enacted, not because the school was failing but because it is deemed to be not as successful as it should or could be. As the MT affirmed:

> Yes, we do get good (NAPLAN) data but we aren't showing growth (WaSSMT).

What is emergent from the pressures from the ARD-SP is a focus on targets, particularly NAPLAN scores, which through My School represent a very public evidence of success. The MT commented:

> Other than your growth from year to year, a school's NAPLAN is that driving data force; it's the be-all and end-all (WaSSMT).

The structural and cultural constraints emergent from an emphasis on external testing regimes was likely felt across the school and particularly by the teachers. This school narrative suggests a more stringent focus on school improvement and accountability than the other three cases.

7.7   Drawing the Strands Together–the Explanatory Model Revisited

This final analysis stage involved a momentary return to the explanatory model in order to ensure that credible causal mechanisms were about to be proposed and that there was sufficient analytical support for the existence of these mechanisms (Wynn & Williams, 2012). Furthermore, alternative mechanisms were examined to seek out the best explanation relative to other explanations in specific contexts. Weick (1989) describes these as "thought trials" (Weick (1989) in Wynn & Williams, 2012). The objective exercise is to "identify the most complete and logically compelling explanation of the observed events given the specific conditions of the contextual environment" (Wynn & Williams, 2012, p. 800). This final return to theory testing and retroduction established the platform from which final CM(A)O configurations were developed.

7.8   Comparing Cases

To draw the threads of these school narratives together, it is worth considering the commonalities as well as how each school case may differ from setting to setting. As illustrated in Chapter 5 and 6, each school was subject to new structural and cultural arrangements associated with policy directions focused on leadership-driven school improvement, more top-down intensive supervisory modes effected by ARD-SPs seeking improvement and compliance (Bloxham et al., 2014), similar funding arrangements[34], and the equivalent data-induced accountabilities in the form

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[34] School funding arrangements continue to be subject to controversy regarding the inequitable nature of how resources are distributed. At the time of data collection, the Queensland Government invested additional funding "to improve student performance in Queensland state schools through the Great Results Guarantee. All 1233 state and Independent Public Schools received a share of the funding subject to entering into an agreement that committed them to guarantee that every student would either:
•achieve the National Minimum Standard for literacy and numeracy for their year level or
•have an evidence-based plan, developed by the school, in place to address their specific learning difficulties."
This was in addition to their normal funding. (Education Queensland, 2014, p.1)

of NAPLAN, MySchool and school dashboards. Here then, collective similarities indicated that in many respects, there was a common baseline across schools for organisational change. Yet, as was signposted in the previous summaries/vignettes, these policy circumstances were enacted and experienced differently. This dynamic directs attention to a point made earlier as to the difficulties of external school improvement processes attempting "to influence from the outside what goes on inside schools" (O'Day, 2002, p.295). On a more granular level, it also reiterates the idea of collective accountability versus individual action; that ultimately, change must occur at the individual agent level (O'Day, 2002).

Accounting for these differences lies with the characteristics of each school's working environment, and the qualities of agential relationships, the nature of interactions and teacher beliefs within. The following CM(A)O configurations are generated to identify generative mechanisms working within and across each school. They are propositions, and as such are not assumed to be unconditional; instead, they are attempts that work to explain certain outcomes in school settings.

7.9 CM(A)O Configurations

These proposed CM(A)O configurations begin with the policy understanding that "the theory of action underlying data use interventions" is that teachers, school leaders, and regional administrators will interact with data and with each other and change their practices to support student and staff learning (Coburn & Turner, 2011b, p. 193). Grounded in this overarching context, a series of interdependent CM(A)O configurations were proposed. Each theorised the processes of change and the anticipated outcomes that might emerge during the successful implementation of new data policies. Accordingly, each configuration is located at a different relational level of the phenomenon strata.

The first CM(A)O configuration examines principal reasoning and action in light of external accountability and school improvement structures and their acceptance or negotiation/mediation of these data expectations (see Table 7.2). It proposes an agential response to the context of data expectations that were emergent from policy, approaches which mandated each principal regularly negotiate new school data outcomes with their respective supervisors. The CM(A)O configuration acknowledges the principal's role as the social agent most able to mediate the structural conditions (policy reforms) emergent from previous cycles of change. Here the engine for change is recognised as "differently resourced agents making constrained choices amongst the opportunities" offered in an open system (Pawson & Tilley, 1997, p.46). Accordingly, in each case, outcomes differed depending on how each principal had made sense of the policy implementation through the lens of

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their relationship with and personal beliefs of data use in schools. This foregrounds the agency and reflexivity of individual actors in the face of the changing ways in which control, power, influence and participation are enacted at this strata level (Couldry & Powell, 2014). Nevertheless, neglecting the new forms of "knowing managerialism" within educational settings (Selwyn, 2015, p. 72) belies the power that accompanies the metrics informing this accountability context.

This context of monitoring and target-setting represents a new intensity in social relations and a new layer in the hierarchy of the state education system. The practices that have emerged from these "micropolitical forms of leadership" demonstrate how power can be understood in "multiple ways; authoritative, sometimes facilitative or as part of shared responsibility" in this new context (Bloxham et al., 2014, p. 33). Clearly, different approaches to these relationships result in different conditions in which mechanisms are triggered.

Here the mechanism concerns capacities as opportunities made available to principals to negotiate with their supervisors (ARDs-SP) and their choices to either engage or resist in terms of their professional identity within this managerial relationship. This mechanism represents a process (Pawson & Tilley, 1997) that describes the interplay of agent reasoning with the power that is made available to principals in terms of their social actor status within the hierarchical education structure (Gable, 2011). These capacities are assigned to them because institutional (leadership) and cultural structures provide them with singular access to power to regulate their schools from the inside. Yet external data accountabilities are now able to reach past these traditional margins and impose a form of data-induced accountability. Here, the principal as corporate agent can mediate these structures, by engaging, resisting or accepting the role imposed by the new forms of managerial knowing, afforded by new access and use of data.

Table 7.4: ARDs–principal's data expectations, managerial knowing and data expectations

Context	+	Mechanism ⇆ Agency		→	Outcome
Principal's perception ARD-SP level of monitoring of school improvement agenda and commitment to levels of accountability	+	Principal's belief systems and knowledge of school **divergent from policy processes**	Degrees of engagement	→	New data processes and expectations **negotiated and mediated** by principal
Principal's perception ARD-SP level of monitoring of school improvement agenda and commitment to levels of accountability	+	Principal's belief systems and knowledge of school **complementary to policy processes**	Degrees of engagement	→	New data processes and expectations **accepted and implemented** by principal

In this respect, each principal made a conscious decision as to how assertively they might implement new data processes within their school as evidenced in the earlier narratives, the levels of agency and bargaining power that accompanied each principal varied. Furthermore, additional questioning of the reasoning behind principals' actions revealed insight into the lower layers of generative mechanisms (Pawson & Tilley, 1997).

The Corymbia principal fully inhabited his role of social actor, and his actions can be attributed to his self-appointed role as a filter for his staff "to protect them from some of the stuff they may not need to do". In this respect, his professional knowledge, tenure length, student success and data beliefs enabled him to resist attempts to change certain data processes in the school. He commented:

> Professional learning conversations that are data-based have to be relevant. I regularly say this to my ARD…and she agrees…whereas others might say "No…I want four data conversations with everybody" …and you know that's just not on for me…I would feel like a fraud. If it's relevant, I do it (CoSSPr).

In this case, the principal deployed a series of strategies designed to negotiate the contested context of his personal beliefs and knowledge and the current education policies promoting data use in schools.

At the opposite end of the continuum, the principal of Waterhousia fully endorsed new modes of data interaction. In this respect, he consciously adopted the discourse of leadership for school improvement, and in his role as a change agent, he was very attuned to the department's expectation of an explicit improvement agenda which focused on NAPLAN outcomes. External interest groups with different values and stakes added to the pressure the Waterhousia principal experienced to focus on data sets (particularly NAPLAN), and as noted before, the public release of data sets like these have reshaped the power relations between this school and its community (Coburn & Turner, 2011b). Here a superordinate-subordinate relationship characterised the interactions (expressed as conversations) between the principal and his ARD-SP (Bloxham et al., 2014).

This form of 'knowing' managerial approach centred on regular interactions concerning the school dashboard and the demand for yet more data. In the context of the principal's perception of the level of power held by the ARD-SP position:

> …when the ARD directs "Every school will…." And the principals do it…(BoSSPr).

There appears not to be any space to negotiate between position-practice systems and some principals are unable to access the powers associated with the school improvement structures. In this respect, this data-induced accountability appeared to reduce principal opportunities to exercise agency and professional judgement. The principal from Botanica commented:

The headline indicators are those that determine what every school is judged on, they determine review level and how much supervision you get from outside, from the ARDs. And we've gone backwards…our NAPLAN went backwards sadly; we were orange there and now we are red and our upper two bands have never done that well against 'like' schools. Sometimes I don't want to look…(BoSSPr).

This preliminary CM(A)O configuration explored principal actions in response to the emergent structural and cultural conditions of previous cycles. Based on the first CM(A)O, it could be argued that principals accepted new roles configured by forms of data-induced accountabilities emergent from a *managerial knowing* approach or chose to resist them in relation to their professional identity and own data beliefs. This, in turn, reshaped the context in which staff in each school were required to negotiate these change management structures.

The second CM(A)O configurations explore leadership and teacher interaction; the proposed mechanisms refer to the interplay between the ideational qualities that might inform data work/conversations and the subsequent utilisation of the exchange to make changes in the classroom (see Table 7.3). Here leaders, (including the master teacher position) are required to mediate between two meta-structures of leadership-school improvement and data-induced accountabilities prior to developing new structural arrangements for data processes in schools.

The mechanisms referred to the interplay between leadership expectations and teachers' decision-making processes, therefore suggesting teachers had the option to engage in or resist these processes dependent upon their levels of agency and belief systems. It was noted that leadership staff in larger urban schools appeared less likely to promote the exercise of agency in teachers. One deputy principal described her approach with a teacher "I want you (the teacher) to go through, and I want you to highlight the critical aspects of this document because this is *our* guide around what *our* expectations are for *you* in *your* classroom" (my italics). There appeared to be little opportunity for any negotiation process, and less opportunity for the teacher's own emergent professional accountability. In this context, teachers must assess both the professional competency of the principal and associated policy directions and consider to what extent they can resist or engage with these processes. One teacher commented:

Because often you get somebody in this role, and it feels like you have got the Department watching you. And you are very keen to improve your pedagogy but it's almost like, "Ooh, I am doing it wrong and I don't want anybody to see that I am doing it wrong because it's going to be reported (WaSST1).

Table 7.5: School leadership and data expectations

Context	+	Mechanism ⇆ Agency		→	Outcome
Staff perception of principals' data expectations	+	Knowledge of school improvement processes **divergent** from new school data practices and processes	Degrees of engagement	→	New data processes and expectations **resisted and mediated** by teachers
Staff perception of principals' data expectations	+	Knowledge of school improvement processes **complementary** to new school data practices and processes	Degrees of engagement	→	New data processes and expectations are **accepted and implemented** by teachers
Staff perception of master teacher data skills and associated 'data' relationships	+	Data interactions and social processes of data **divergent** from teacher professional beliefs	Degrees of engagement	→	Staff **resist and mediate** new data processes, data target setting and accountability requirements
Staff perception of master teacher data skills and associated 'data' relationships	+	Data interactions and social processes of data **complementary** to teacher professional beliefs	Degrees of engagement	→	Staff **accept and implement** new data processes, data target setting and accountability requirements

In this respect, specific situational logics predispose agents towards courses of action that shape the situations they are in by supplying good reasons in the forms of rewards and consequences for various actions (Archer, 1995). Here then, the focus lay in building relationships with staff around data use. One master teacher summarised this dilemma:

There's that relationship stuff, let alone the accountability stuff …if it's going badly…if it's not dealt with in the right way, it goes from being a 'coaching' thing to an 'over the top' thing. And we can't be 'surveillance' people because we will have no trust with (the teachers) - we walk in/out of the classes all the time. If they think

we are on surveillance, it will be - you know! So, it's good; they know we are not surveillance. We are in that coaching role (WaSSMT).

A case in question, the Brushbox principal, drew together her small staff from the beginning of each year, building rapport and nurturing social relations around the sharing of data and attainable goals. Her "highly operational team" relied on a brief that collected and documented both formal and informal data on each student and then shared this data across the school during scheduled meetings and impromptu moments. These dedicated conversations around data built a picture of changing social relations of data usage and suggested data morphogenesis of agents. They also represented the completion of a series of causal processes, designed to stimulate mechanisms for change in each school setting (Horrocks, 2006).

In each context, new data and new data expectations required leaders/leadership teams to change the way they interacted with teachers and teacher aides. New or recycled data processes included regular professional learning conversations, data talks and conversations, data target-setting and observation processes, data wall interactions, mandated data collection points throughout each term, and regular leadership data meetings. A series of meticulously thought-out school structures provided relational structures that supported teachers in their data work (Priestley et al., 2015b). Here success for the leadership team might come in the development of a *collective knowing* in staff, one that legitimised school data policy and process decisions.

This is the context in which teachers assessed the professional competence of the leadership team. Here the perceived quality of staff involvement in data interactions and processes are linked to, firstly, the power structures within the school and secondly, the development of trust in the actions of the leadership team or more specifically the master teacher role. In this respect, teachers who were concerned about new school data practices were more likely to respond to the 'data coaching' of the master teacher than the implied 'surveillance' associated with regular data conversations and target setting. However, each process relied on building a relationship with data and the associated language of data for school improvement, while avoiding provoking an atmosphere of accountability. This trust in numbers extended beyond standardised testing instruments to include the numerous local instruments and tools that generated local data. A master teacher commented:

> I think everyone knows now. I think what the focus on data and data collection does
> is let the teachers know that we are serious about improvement … and we are
> investing in that. We need to know our kids and we need to do something about it. I
> mean we as a team and the teachers know we are going to be looking at every student

and we need to be thinking about every students' data… and if they are not

improving. If not, why not? What are you doing about it? (BoSSMT).

More data equalled better data in each case with some pockets of resistance and questioning of the proliferation of data collected. One teacher commented:

So, there's the sort of data that's interesting. However, some of the other data that we

are asked to do, sometimes I think, "Well, mmm, maybe, is it collecting data for

data's sake or is it for someone else's purpose, because they need the data for

someone else above them…who needs that data is the question?" (BoSST1)

However, more generally, intensified data review and use characterised leadership teams' interactions with staff in each case school. Here successful outcomes in each school relied on these interactions to construct data-responsive teachers and teaching teams (Lewis & Holloway, 2019). These dual CM(A)O configurations are represented in Table 7.3.

Accordingly, the mechanism/s refer to the interplay between the reality of teachers' professional knowledge and their preparedness to use evidence in their day-to-day work. Here conflicting views of competency pit the professional judgement of teachers against new 'knowledge' afforded by data. Data expectations place pressure on schools to continually use evidence to guide their school improvement and accountability efforts (Coburn & Talbert, 2006). In this respect, the unequal status afforded teachers' own knowledge and the central drive of data policies for school transformation set up uneasy relationships likely to not wholly support the anticipated changes and impact.

The third CM(A)O configuration theorises how staff respond on an individual level to new data processes (see Table 7.4). This draws attention to why teachers may or may not participate in data-use processes and what might support engagement or resistance to these processes. Individual teachers interviewed appeared to not overtly challenge the new modes of data use. In place, instead was a cautious acceptance that having the data provided a form of *personal knowing*, that legitimised the new practices and processes introduced. Here the objective 'truth' qualities afforded numerical data were accepted (Lewis & Holloway, 2019) with little recourse to questioning. Subsequently, personal effectiveness in the classroom was sometimes judged by NAPLAN improvements, driving what occurred in the classroom (Henman & Gable, 2015). One teacher noted:

The thing that has really pushed me has been the NAPLAN test. I know the data we are going to get from the NAPLAN test, I know the kids are going to do it, they are going to be measured, and I know we are going to be judged against that (CoSST2).

Table 7.6: Individual teacher data interactions

Context	+	Mechanism ⇄ Agency		→	Outcome
Teachers perception of a **supportive** professional culture	+	Confidence in professional competence **recognised**	Degrees of engagement	→	Teachers **identify and manage barriers and challenges** to increasing data focus and processes
Teachers perception of a **data-driven** professional culture	+	Confidence in professional competence **not recognised**	Degrees of engagement	→	Teachers **must engage** in increasing data focus and processes

Staff engagement with data processes continued to rest with their teacher beliefs, yet there appeared to have been an evolution in understanding in some teachers that impacted on their relations with data. Attempts that connected data with individual students (data walls) supported this ideational shift by framing and presenting the student in a way that served to inform, motivate, and make the teacher accountable all at once.

In this context, individual teachers now judged their own professional competence in relation to data. Here the perceived quality of a teacher's work appeared to have been inextricably bound to the two structures, school improvement and accountability, where a teacher is often required to assess their performance according to student success in single standardised testing regimes, alongside other forms of school data. In this respect, teachers who were confident with data found this focus empowering, enabling them to drive the school improvement agenda forward, while others found the data negotiations marginalising and responsible for reducing the teacher's confidence in their professional ability. One teacher commented:

I think it's changed. Before, yes, there was a trust, that you were doing your own good job and – yeah, there wasn't all this checking. But sometimes it does feel like 'checking', "What are you up to?" And you do think, "Well, my kids aren't moving. Why aren't they moving?", whereas - so, yeah, less trust (BoSST1)

This is compared to another teacher on the same staff who took the opposite stance:

The only way that you are going to move forward as a society is to share stuff, be open with it, which is what all this data is for. It is just to make everything open and clear (BoSST2).

As long as you are in the review process, with your data…you can say, "As a school, this is what we are doing with our data. This is how we are trying to meet your students' needs". And if parents understand that there is data, it is in place and it is driving the school to improve, I think the whole stigma surrounding it is going to change in the next five/ten years, and people won't feel so threatened by it (BoSST2).

Accordingly, the mechanism here refers to the capacities and opportunities afforded teachers to develop teacher (data) agency through relational resources, networks and connections, alongside new knowledge and ideas that promote professional learning (Priestley et al., 2015b). This mechanism is a process that intertwines agent reasoning and knowledge with the possible emergent power of data that might enable or constrain teachers' actions dependent upon the school's structural arrangements, their personal beliefs and social interactions. As agents, therefore, teachers still have power and can position themselves to resist, challenge or engage in the emerging data culture. This CM(A)O configuration is presented in Table 7.4.

The final CM(A)O configuration presented in Table 7.5 illustrates the stratified nature of the research space. The causal configuration developed for each stratum level tentatively connected outcomes across three different levels. In this sense, the analysis follows the outcomes from the institutional context through to the individual perspective uncovering an outcome that suggests the morphogenesis of agential relations with data and subsequent shifts in data use. Here chains of mechanisms and outcomes are linked to (i) the material and ideational properties (policy reforms) emergent from school improvement and accountability; (ii) principal negotiation of external forces, through questions associated with (iii) teacher professionalism and professional knowledge and the eventual impact on teachers' professional identity. From this perspective, these causal chains and mechanisms are aligned with the general response of agents and actors to the datafication of educational spaces and the data-induced accountabilities that it affords. The result is an insight into how new ways of knowing have intensified social relations of data use across several educational strata.

Subsequently, several research outcomes are acknowledged here. First, principals as social actors have the agential power to mediate structures emergent from new accountabilities informed by datafication; however, only when certain position-practice/belief systems and contextual factors were in place. Second, intensified data interactions, within groups and between individuals

appeared to shift collective understanding/knowing. These might be conceptualised as either data conversations/talks or evidenced-informed professional learning. This proposes that in a context of collective knowing that values teacher decision-making, teachers will respond positively.

Table 7.7: Stratified CM(A)O table of mechanisms, interaction and agency

Context	+	Mechanism ⇆ Agency		→	Outcome
New social relations with data, target-setting and professional learning professional identity	+	**Individual knowing** capacities and opportunities afforded teachers **to develop teacher (data) agency through relational resources, networks and connections,** alongside **new knowledge and ideas that promote professional learning**	Degrees of engagement	→	**Morphogenesis of data use and agents**
Collective knowing Principal professional identity and agency	+	The interplay between leadership expectations and teachers' decision-making processes, therefore suggesting teachers had the option to **engage in or resist these processes dependent upon their levels of agency and belief systems**	Degrees of engagement	→	**New social relations with data, target-setting and professional learning**
Managerial knowing New data structures Leadership, school improvement and data induced accountability	+	Capacities as opportunities made available to principals to negotiate with their supervisors (ARDs-SP) and **their choices to either engage or resist in terms of their professional identity within that managerial relationship**	Degrees of engagement	→	**Principal professional identity and agency**

Alternatively, if this collective knowing is characterised by target-setting and surveillance, teachers will question their professional judgement and express some concerns. Finally, teacher engagement with new data processes relies on the modification of teacher beliefs at a deep knowledge level. The analysis suggests, teachers at the case study sites overcome an initial hesitancy when faced with data, where data might be simultaneously appreciated and critically

assessed, resisted or engaged with (Lewis & Holloway, 2019). It is argued that this engagement with, and knowledge of data remained in the empirical and the actual, rather than a deeper engagement with data in the real. Here the 'visibility' of data informs perhaps new modes of teacher *belief* in data rather than actual knowing.

This poses an interesting question to the researcher that would require further investigation beyond the scope of this work. However, it does direct attention to Milan and Van der Velden's (2016, p. 70) question of "What new participatory methods can we envision which can best incorporate the criticism to dominant epistemologies of knowing advanced by data activism?" This raises complex questions about the knowledge status of data in schools and how that knowledge is valued by teachers, administration staff and their supervisors.

7.10 Exploring outcomes – Social realist explanations

Accordingly, in answer to the final domain-focused research questions:

- How does engagement with data inform professional practice and teacher learning in primary school contexts?
- How might data use constrain or enable principal-teacher agency within the Queensland state primary school environment?

Engagement with data creates and sustains a context that appears to tether professional identity and teacher learning to constant engagement with data. In this respect, specific processes of data use in case schools have created a form of data-induced accountability that has reached into schools, past the noted privacy of the classroom, in turn coaxing and coercing teachers to engage in (or resist) these new practices. These new data-influenced environments varied across school settings, often conditional on principal agency. However, recalling the stratified levels of engagement, broadly, data initiatives enacted through the relational level found their way through to the individual level. In short, data had provided the means for external school improvement and accountability policies to change the inner workings of schools.

Additionally, several generative mechanisms were determined to be operating within these structural and cultural emergent conditions. Principals had within their capacity, the opportunity to challenge, resist or reproduce their respective roles as the intermediaries between the external accountabilities' representative in policy reforms and the internal social interactions of a school. Moreover, the consequence of principal response to these external influences determined the leadership team-staff dynamic and the nature of interaction that emerged concerning data in the classroom. Accordingly, teacher professional knowledge and judgement is validated and accepted

or made redundant in the face of new external evidence for school improvement. Finally, teachers are positioned to work within emerging target setting and surveillance or professional learning and coaching-type social relations. Here, they have the opportunity to consider the nature of data use and its impact as well as its potential to improve outcomes for the students in their class.

The emergence of principal and teacher agency concerning data is likely to rely on the possibilities of personal and social identity coming together. The complex place data initiatives hold in school improvement policies and processes require attention to be paid to how these processes are received and enacted by teachers. Furthermore, the analysis suggests that the extent to which principals and teachers can mediate these data initiatives relies on their collective and individual ability to negotiate between the co-occurring structures of leadership–school improvement and data-induced accountability, where each agent may well traverse the tensions engendered by the resulting position–practice systems. In short, teacher data agency might be possible in circumstances that trigger professionalism and sense of professional identity through transparent data interactions and respectful relationships that value teacher insight and knowledge. Teacher agency is less likely when these data-driven interactions are characterised by targeting-setting and surveillance practices that re-shape the teacher in their role as a professional and can shift the teaching focus away from other educative practices (Lewis & Holloway, 2019).

These tentative research outcomes indicate that teachers, and particularly principals, have the potential to resist or engage in new data practices dependent upon their beliefs and knowledge. To avoid activating mechanisms that trigger resistance, those who design and implement school improvement policies might consider the tensions engendered by multiple conflicting structural and cultural arrangements associated with data-use interventions. Here, the challenge of datafication lies in the new ways of knowing schools that do not consider the ontological and epistemological consequences of what new data is and from where it emerged. Therefore, teacher professional knowledge/learning and interaction should focus on understanding the effects of emergent data practices and use, with a view to unpacking the 'black box' of data. Subsequently, data processes that respect local context and knowledge might better serve the aims and objectives of improved student outcomes rather than intensive focus on external international and national data standards and the subsequent risk of performativity without agency.

7.11 In Summary

Chapter 7 examined the influence emergent structures of professional identity and knowledge had on modes of data use in the four research schools. What emerged was the option of mapping the various relationships made possible (and impossible) by new ways of knowing in

schools. This completed a process that traced structural and cultural emergent properties across four strata, namely, infrastructural, institutional, relational and individual.

A series of CM(A)O configurations were implemented that sought to explain the changes that new uses of data had produced in each school. Each configuration acted as a proposition that might explain the actions of mechanisms which had generated the eventual patterns of social behaviour and interaction evident in each respective case (Pawson & Tilley, 1997). Initial engagement with data identified levels of engagement and resistance to data in school contexts. These differences served as the focal point for analysis, the research arguing that case differences might lie in the types of sociocultural interaction that were generated by data use in each school. Here, the "pushes and pulls' of school improvement and accountability are enacted in school contexts, engendering by turns, enabling and constraining conditions that can be mediated, yet, not avoided, according to agential knowledge and experience. Accordingly, three forms of data knowing; managerial, collective and individual were posited as emergent from these sociocultural interactions and likely to influence the morphogenesis of data use and teacher agency. To conclude this project and consider these empirical outcomes, the final chapter explores the theoretical implications, methodological challenges and practical outcomes of this research.

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8. Research Outcomes and Conclusion

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8.1   **Introduction**

This final chapter presents the discussion and conclusion to this study in four parts. In this respect, the intention is to move beyond the repetition of analysis outcomes to situate them in a larger context. First, I return to the original research questions to consider them with respect of empirical outcomes and theoretical understandings. Second, I explore the limitations of the study from theoretical and methodological perspectives. Next, my attention turns to the contribution of this study to further understanding and study of data use in education. To finish, I reflect on the implications of this research for teacher agency and data morphogenesis in education systems.

This research commenced with the position that some education research regarding data use in schools and systems is limited in its possible impact and that critical realist meta-theorising has something to offer in terms of laying the foundations for more credible research returns. Furthermore, the general difficulties of researching complex social phenomena such as data use in education were recognised, and a social realist approach was posited as a means of providing valid accounts of agential experience and outcomes. Here the focus was on building explanatory theory, situated at the level of the real, and identifying mechanisms and their emergent causal effects in conditioning the work of teachers in a data-laden space. These explanations draw together an understanding of why such outcomes emerge and tentatively consider how to design new systems and policies that might support alternative outcomes (Case, 2013).

An initial review of the research bases indicated that challenges existed with both the magnitude and complexity of the research space and identifying an appropriate way forward concerning methodological choices. Critical realism provided a practical set of meta-philosophical 'tools' that served to underlabour, initially to clear the ground and then to provide further structure that supported the adoption of Archer's realist social theory. Here, Archer's morphogenetic approach contributed a stratified model of structure, culture and agency, which maintained the distinctiveness of each and supported the mapping of their interplay across time. An equally important contribution was the social realist concern for the interwoven nature of research activity and theory.

The issues concerning the conceptualisation of the research phenomena, given its relatively nascent form and the complexity of the research problem, were identified in Chapters 2 and 3. Here, it was "necessary to move from a general meta-theory to construct a domain-specific meta-theory" that critiqued the terms of reference informing existing perspectives, prior to developing a new set

of reference points concerning agential response to new ways of knowing afforded by data (Cruickshank, 2003, p.130). This theorising was used to inform the empirical aspect of the research, and as the research progressed was revised to accommodate new understandings. This process emphasised the theoretical, methodological and empirical issues of researching a rapidly emerging research phenomenon. In this respect, researchers are always playing catch-up as they seek alternative narratives to describe research phenomena.

While the knowledge claims of this case study depend on "identifying the deep processes at work under various contingent conditions via mechanisms", they are not considered generalisable in the broad sense of the word (Easton, 2010, p.126). Here, causal explanations of one comparative case study are based on the best likely explanation; that is, the one most consistent (and possible) with the data and theory (Easton, 2010). Accordingly, this is a research process that relied on considering how these mechanisms might apply in each educational context and consequently produce similar/different outcomes. As such, the outcomes are not understood as generalisable but rather offered as explanations that may provide some understanding in other contexts.

8.2   **Overview of Research Outcomes**

The motivation for this study emerged from my own lived experience and a further problematisation of the literature which examined the nature and role of data use in schools. A synthesis of the knowledge bases noted that wide-ranging dimensions and dynamics matter in how data use evolves, from individual agential aspects to organisational factors through to broader policy and political considerations (Coburn & Turner, 2011). The process of datafication, described as "the new ways of seeing, understanding and engaging with the world through digital data", underscored how "data makes things visible, knowable and explainable", and consequently open to action and intervention (Williamson, 2018, p. 1). Consequently, new forms of data and individualised patterns of data availability were likely to support more intensified interactions and relationships. The new data accountabilities that were observed had implications for the relationships emergent across relational levels in education systems. These also drew attention to the kinds of relationships made possible by the new forms of data accountability. Additionally, they also questioned what kinds of relationships are made *impossible* by the same culture (Biesta, 2009a).

Educational data policy and governance driving reform emergent from these new ways of knowing has directed attention to probable tensions in the knowledge bases, that informed data use in schools. A CR perspective revealed the possibility of contradictions in what agents thought could be known from data (epistemologically) and what data really are (ontologically). It also suggested

there were very real consequences in the way data are shaping agential action, experiences, relations, decisions and choices across educational strata (Williamson, 2016). Accordingly, a CR underlabouring process was used to problematise and subsequently propose an alternative approach to investigate these tensions in the implementation of school improvement and accountability policies in schools.

Although the research focused on the impact that data-based interactions and governance had within schools, it began with a wider analysis of the conditions that had wrought these changes. This theoretical stance argued that broader understanding lies in considering the context in which these interactions take place (Case, 2013). In this respect, the research was located across four contextual strata: infrastructural and institutional levels to relational and individual levels in the search for generative mechanisms and significant social relations. Archer's (1995) realist social theory of the interplay between structure, culture and agency supported the analytic distinctiveness of these domains and consequently provided practical methodological support to the CR underlabouring process.

The data collection and analysis were guided by the following questions:

- What pre-existing structural and cultural conditions influence the way data is used in Queensland primary schools?
- What are the key dimensions of data use in Queensland primary schools?
- How does engagement with data inform professional practice and teacher learning in primary school contexts?
- How might data use constrain or enable principal-teacher agency within the Queensland state primary school environment?

A review of the research outcomes, which consider these research questions, is presented here over three sections.

8.3 **Structural and Cultural Conditioning**

The problematic nature of the rise of data as a social, political and cultural form has been a growing concern (Lawn, 2013a; Selwyn, 2015; Williamson, 2016). While the prominence of data in contemporary education is recognised in some fields (e.g., educational policy sociology), there have been more persuasive calls recently to address the sociological significance of data (Milan & Van der Velden, 2016; Selwyn, 2015; Williamson, 2016, 2018). This apprehension lies in the creation, (dis)aggregation and flow of data and the role it plays as a governing tool in education (Hardy & Lewis, 2016; Lingard & Sellar, 2013; Sellar, 2017); the increasing reliance of the world on 'big'

data (Lycett, 2013; Wise & Shaffer, 2015), and the possible forfeiture of "the freedoms and trust associated with professionalism" (Selwyn, 2015, p. 76). It was noted in this research that educational researchers, policymakers and teachers were increasingly interested in the research base. However, the complexities that lay in the multiple levels described needed to be addressed in order to make initial sense of the research space. Therefore, this thesis research reasoned that understanding how data are being used in schools did not lie only in school-based research; it required a broader approach that situated data use across multiple scales (Sellar, 2017). Accordingly, this research responded to this call for a more critical approach and subsequently directed attention to the consequences of data use and its potential to reshape social relations within and across educational contexts.

This question of scale or strata was addressed early in this research. Here, certain forms of data as instruments of governance, surveillance and performativity in education were traced across four distinct yet interrelated strata: infrastructural and institutional settings, and relational and individual perspectives in an Australian schooling context. This research contributes to the debate on one level by emphasising the linkages between these different scales and making visible some of the cascading tensions that emanate from the new ways of knowing in education to which data have contributed. In examining these tensions from an Archerian perspective, prior structural and cultural elaborations were made visible to understand the contemporary conditioning in place in each educational context (Case, 2013). The interaction of these conditions was considered most likely to enable and/or constrain agential action in the research setting.

By re-directing attention to the structure-culture-agency dynamic, the study examined the difficulties that external control policies confront when attempting to change the internal workings of schools (O'Day, 2002). To better understand this reform process, the research considered why structural and cultural conditioning in action might not play out as intended. Archer (1995) describes these situational powers in this way, "It is only their specific relationship to the particular projects of particular agents in particular positions, which allows us to describe their conditional influence as being a 'constraint' or an 'enablement'"(p.198). This observation underscores how human agents can mediate their social conditions and also considers the hidden, underlying conditions/mechanisms that may impact these socio-cultural interactions.

Previous research had suggested that new policy strategies had concentrated on building principal capacity in an approach that combined both performance appraisal and professional development (to a lesser extent) focused on data expectations, data expertise and professional learning (Bloxham, 2013; Bloxham et al., 2014; Gable & Lingard, 2015; Heffernan, 2016). Yet

these leadership-focused school improvement activities did not always have the intended results. Gable and Lingard (2015) argue that the partial outcome of this focus is a form of principal coupling or decoupling from these attendant policies depending on the context. This study supported this understanding, where seemingly compliant behaviour on the part of the agent did not always result in intended outcomes. Bromley and Powell (2012) argue that this is sometimes a consequence of unclear and reduced links between activity and outcome (Gable & Lingard, 2015). However, in this case, the principal as an agent mediated the policy governance process through a series of complex negotiations that relied on both material and ideational resources and the principal's role as a powerful social actor.

Drawing attention to the unevenness of this reform process, this research directs further awareness of the structure-agent dynamic and considers explanations as to why these structures in action may not influence as widely as first conceived. It also considers what hidden mechanisms might be influencing agent action at each school site. The research confirmed that structural and cultural conditioning in the form of policies attached to school improvement and accountability might have reduced effect in some school contexts. These interacting meta-structures, underpinned by "competing theoretical perspectives which in turn produce two different sets of attitudes, beliefs, values and practices" in teachers were unlikely to produce the desired outcome of organisational change and improvement (Gable, 2011, p. 262).

Consequently, in the bid to align new school improvement/accountability data policies with professional practice, administration staff (and those who manage administration staff) did not always account for the challenge of aligning different sets of data beliefs and knowledge within a school setting. This can be partly attributed to the conflict that emerged when teachers and principals had to operate within the position-practice systems that emerged from the interaction between the meta-structures of school improvement and accountability. Considered in relational terms then, the congruence or incongruence between these two sets of powers was likely to give rise to situations which agents might find enabling or constraining (Archer, 1995).

The study highlights the conflict that arises when data is viewed as both problematic for schools (as an accountability tool) and essential to school improvement. Identifying structural and cultural emergent conditions from new data use policies draws attention to how the implementation of these policies may result in counterintuitive outcomes in school settings. In this respect, the study contributes to knowledge by considering the consequences of aligning data use with both school improvement and accountability structures for school reform. It also begins the project of

articulating the associated complexities that arise with the datafication of or new ways of knowing schools.

This explanatory phase argued why the structural reform associated with new data uses in schools might be considered challenging. The next section considers the emergent social relations from these structural and cultural conditions and their subsequent interaction at the school level.

8.4   Socio and Socio-Cultural Interactions/Data Dimensions

The outcomes of this research consider what social arrangements might emerge as significant from the enactment of new data policies in schools. Data-use interventions tend to rely on an underlying 'theory of action' which argues that teachers will interact with data and subsequently change practice; yet, this conception belies the complexities of new dimensions of data use. These complex arrangements take place in open systems, which implies multiple mechanisms working together, alongside each other or from opposing positions. Furthermore, people's (agents and actors) behaviour and actions continually influence and alter the set of objects and mechanisms in the environments with which they cooperate and interact (Danermark et al., 2002). Archer (1995) argues that despite social and cultural structures, and potential agential activity being empirically intertwined, we can separate them analytically, to "examine their interplay" (p. 247).

Accordingly, the outcomes of this research isolated several likely structural conditions with significance for data interactions at both the relational and individual strata levels (see Figure 7.2 contextual strata). Initially, seven data dimensions[35] were identified as likely structural conditions interacting with agents in each school setting. These results were further refined to reveal three data dimensions influencing data engagement at a relational and individual agent level (see Figure 8.1). Of the three—professional identity/knowledge, data interactions/professional learning and target-setting/expectations—the emergence of a data professional identity/knowledge was isolated as influential in certain case instances.

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[35] Data dimensions operating in the school setting
1. Data use and professional identity
2. Data interactions and communication
3. Data target setting and surveillance
4. Data norms
5. Data as resource
6. Data and professional learning
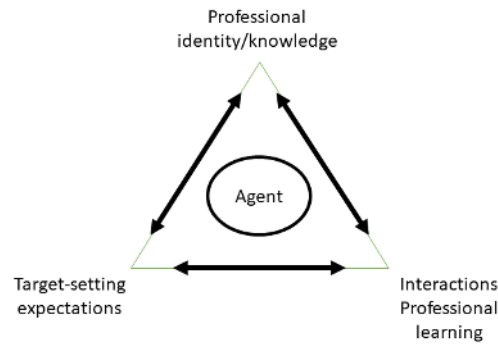7. Data visualisation

Figure 8.1: Structural/cultural conditions, data interactions and dimensions

The research outcomes considered how these conditions might interact with social actors and groups of agents to shape the outcomes of data processes in schools. In this respect, the social realist analysis sought to unravel the various data relationships that emerged from new ways of knowing in schools.

Teacher beliefs, combined with a strong sense of professional identity, are considered instrumental in shaping teachers' practice (Priestley et al., 2015b). Consequently, policy makers and leadership teams often put significant effort into changing these beliefs, yet in many cases, teacher beliefs remain relatively immune (Nespor, 1987). In the case studies presented, the school narratives explored the processes and procedures implemented to effect this transformation and the subsequent outcomes. This research confirms that new intense data interactions might be successful in some circumstances; however, more experienced teachers often defaulted to previous professional models. This theme substantiates the difficulties involved with progressing from producing and examining data to actually using it as a means of school improvement (Earl and Timperley, 2008). Some school leadership teams appeared more successful at this process than others.

Furthermore, knowledge of (or the lack of) data significance, data analysis, data origins, data interpretations and the knowledge of what data are (Coburn & Turner, 2011; Williamson, 2016) in turn enabled or constrained agential action in each case school (Milan & Van der Velden, 2016). In some circumstances, far more nuanced use of data was taking place compared with the data work in other places. Knowledge of data analysis was seen as the often-missing key to assisting teachers in making appropriate sense of the various and sometimes conflicting sources of data. Likewise, the reductive nature of some data and associated data practices continued to concern both teachers and leadership teams.

The continuing importance of agent interactions was evidenced in some of the school-based interactions. Coburn and Turner (2011) argue that data use in and out of schools is a sensemaking activity that is seldom an individual endeavour. These interpretative, and sometimes performative interactions, are nearly always influenced by negotiation, communication, collaboration and interaction with others across different contexts (Spillane, 2012). Cultures and structures of performativity impact on teacher agency and challenge the accepted ways of doing things (Priestley et al. 2015). Accordingly, the significance of different forms of interaction in crafting the social dynamics around data use remained important in each school setting.

This research confirmed some of the challenges faced by policymakers and administration teams endeavouring to change teacher belief systems and their data knowledge. Organisational cultures formed around data use within educational settings mirror some of the existing institutional structures and their associated hierarchies; yet, as this study demonstrates new uses of data tend to disrupt current arrangements (Selwyn, 2015). The evidence suggests that considerable resources were applied to this dilemma; the result being data-use processes were part of carefully conceived school structures. What emerges in each setting are new understandings and significant new social relations that redirect attention to what is measurable or can be made visible with data. Here this thesis argues that these new ways of knowing emerged from the interaction between the new structural and cultural conditions and agential mediation of data arrangements.

The study proposed three domains of data knowing influencing social relations in schools: managerial knowing, collective knowing and personal/individual knowing. Each is situated in a different strata level. Consequently, each is likely to reflect the emergent nature of data relationships and the impact on teacher agency they might have in each context. In this respect, actual outcomes in each context are always a matter of agential mediation of emergent data conditions. Here, the study aimed to foreground "the agency and reflexivity of individual actors in the face of the ways in which data power and participation are being constructed and enacted" in schools (Couldry & Powell, 2014, p.1).

The research outcomes build on Selwyn's (2015) conceptualisation of a "new form of knowing managerialism" described as "the role of managerial interests in gathering data and information in an ongoing attempt to make sense of the everyday" (p. 72). Managerial knowing is exemplified in the act of setting data expectations and the performative act of meeting those expectations. The analysis in this research suggests that a form of managerial knowing is at the heart of the relationship between principals and their supervisors. Collective knowing emerges from experiences designed to engender collaboration that supports mature interpretative processes (Earl

& Timperley, 2008). Interpretation is seen as crucial and is viewed here as "thinking – formulating possibilities, developing convincing arguments, locating logical flaws and establishing a feasible and defensible notion of what the data represent" (Earl & Timperley, 2008, p. 9). In this respect, collective knowing is the aim (if not always the outcome) of school improvement processes embodied in data talks and data conversations explored in this study.

Finally, this study reinforced the proposition that while school improvement policy focused on data use might target schools as units of intervention, fundamentally, ensuing change relied on firstly, collections of individuals, and then ultimately at the personal or individual level (O'Day, 2002). In this respect, teachers and principals are required to change what they are doing and the way they are doing it to have an impact on student learning. This research suggested that teachers' deep relationship (in the real), *with* and their understanding *of* data were likely to be influential. Here the challenge lies in aligning individual teacher professional identity with new models of data use. The research implication here is that to develop teacher professionalism more capable of using data to support student learning may require processes that support a better understanding of what data is and what can be really known from data. Accordingly, school change and the possibility of agent morphogenesis depend on a form of personal or individual data knowing.

As this research demonstrates, engaging in this kind of educational reform is likely to result in multiple agent responses. These agential responses tend to fall on a spectrum: one end challenges and/or resists the encroach of data from a professional teacher identity perspective, the other end engages and possibly embraces both the technology and the opportunities afforded by new modes of education data (Milan & Van der Velden, 2016). Furthermore, this analysis suggests that there is constant change as agents' cultural and ideational preferences shift to encompass new modes of accountabilities. The result is a complex arrangement of social relations that may or may not support teacher data agency.

This explanatory phase considered the complex relations emerging from new data arrangements in schools. The next final phase considers how a form of data agency might emerge and be sustained within such an environment.

8.5   Morphogenesis of Data Agency

Central to Archer's morphogenetic cycle of change or reproduction is human interaction (Case, 2015). In the same way that structural and cultural systems are systematically remodelled (or reproduced) by agential action and interaction, social agency is simultaneously being transformed as well (Archer, 1995, 2000). Accordingly, the research considered the importance of these

interactions as it accounted for the conditions and qualities that might enable or constrain teacher agency. By directing attention to the structure-culture-agency dynamic to better understand the school reform process, explanations are possible as to why structures in action may not result in their original objective (Gable, 2011). In this respect, the hidden mechanisms that might enable or constrain agent action in each school setting were potentially revealed.

This research focused on the role of principal/teacher agency in negotiating new data environments. In this respect, agency is considered to be "the capacity of individuals to act reflexively within the possibilities bounded by their social and material environments to effect changes to their conditions or reproduce them" (Priestley, 2011a, p. 16). Here, agency acquires both a backward- and forward-looking dimension, while being analytically located in the present (Emirbayer & Mische, 1998). Priestley (2011a) argues that this past, present and future orientation provides a central space or opportunity to "manoeuvre that makes (data) agency possible" (p. 17). Yet, what does individual teacher agency look like? In this case, a form of teacher data agency may be confirmatory where the teacher reaches for the democratic possibilities of data (Milan & Van der Velden, 2016). It may be emancipatory where this data agency seeks to uncover the power relations associated with new forms of data governance (Ruppert et al., 2017). Alternatively, it may exist as a form of data activism where teacher agency "questions the dominant narratives and ways of knowing the world" (Milan & Van der Velden, 2016, p. 69). However, teacher data agency as an outcome is not just acquired through an ad hoc process; this research confirms it requires careful attention and consideration.

Critical realist research emphasises that various combinations of contexts and mechanisms might operate to achieve the same outcome or something quite different. What is apparent is that understanding relies on establishing the key relationships in each stratum and the emergent powers arising from these relationships. Sayer (2000) argues the importance of understanding how the operation of causal mechanisms is dependent on the limiting and empowering effects of contexts. This research exposed the contextual enablers (and constraints) likely to induce forms of agency in teachers and principals and consequently better educational practice and outcomes for students.

The research identified three such mechanisms: that principals through their social actor status are able to resist or engage with the assigned role of data leadership for school improvement; that teachers have the potential to engage in forms of data-led professional learning dependent on the development of their professionalism and professional identity concerning data; moreover, individual teachers who are able to transform data practices yet may actively or passively resist

engagement according to their knowledge and beliefs of the role of data in their class. Each of these considers the attainment of agency in relation to data across different contextual strata.

Accordingly, this research argues that teacher data agency is an emergent phenomenon, that is, "something that is achieved by individuals, through the interplay of personal capacities and the resources, affordances and constraints of the environment by means of which agents act" (Priestley et al., 2015b, p. 19). This conceptualisation emphasises individual capacity, contextual elements and the accompanying social relations that shape the accomplishment of agency across time (Priestley et al., 2015b). In other words, teacher data agency is possible in an environment that embeds opportunities for professional learning and data interaction in daily practices of dealing with data. In this respect, leadership teams could focus on building knowledge of data use while recognising teachers' professional knowledge. This is a complex arrangement which focuses on modes of daily interaction and emphasises a much higher degree of ongoing collaboration and coordinated responses to data and problem-solving than previously expected. This is a strengthened version of the professional learning communities currently advocated for improving practices in schools and would suggest more intensified social relations as a result.

Successful implementation of new data processes requires intensive engagement and interaction between agents at each level of the strata. Accordingly, this research considered data use in schools from four perspectives or strata. It made the case that a stratified understanding of teacher data agency is important in this process because it pays attention to the structural and cultural conditions under which agency might be achieved, as well as the capacity of individual teachers (Priestley, Biesta, et al., 2012; Priestley et al., 2015b).

A second point of the research outcomes draws attention to a teacher data agency that does not necessarily preclude accountability or total resistance to data processes and engagement. It does, however, suggest that data processes recognise the professionalism of teachers and somehow enable them to achieve data agency (Priestley et al., 2015b). This might seem problematic in current climates of performativity, where it appears accountability for education has become removed from the informed judgement of teacher professionals (Henig, 2013). However, as this research suggests, there is real potential here to shape systems that harness the power of serviceable data with an enhanced view of data professionals; teachers who recognise both the structural and cultural constraints and enablements of data and are able to develop new competencies that support improved student outcomes.

8.6   **Limitations and Possibilities**

Although the theoretical and methodological framework presented a suitable means to address the research questions posed, several limitations should be acknowledged. There were three sets of constraints considered important to this work. First, those posed by the methodological process which drew on an amalgam of critical realism underlabouring, realist social theory in the morphogenetic cycle and a form of realist enquiry which seeks to form a generative model of causation. Second, those posed by any qualitative social science research. Third, those presented by the slight shortfall of supporting qualitative data that would have added further strength to the research outcomes (Herepath et al., 2015).

Criticism could be extended to the research outcomes of this intensive case study where the established causal links might be seen as insufficient to justify explanations. The response to this is, as an intensive empirical procedure, "the type of account produced is a causal explanation of the production of certain events/objects", though these are not necessarily seen to be generalisable or representative (Sayer, 1992, p.243). Intensive case studies, by definition, are looking for substantial relations and perceivable connections between causal groups and not the representative generalisations of extensive empirical procedures (Sayer, 1992). In this study, the focus was on how a mechanism/s might work in certain concrete situations, such as the case schools, or education systems by tracing causal powers and how their interactions might result in certain phenomena (Danermark et al., 2002). In this respect, the causal power of objects might be generalisable to other contexts; however, it is not an assumed outcome. This account suggests that further research could be justified to determine whether the identified mechanisms are likely to be present in other cases and if they might contribute to other unidentified events.

Any form of qualitative analysis may be said to be influenced by the researcher's viewpoint, beliefs, knowledge and research/life experience, and consequently, is open to the criticism that the complete analysis is only an individual interpretation. An initial response to this is that the methodological process is one of theory testing, which relies on the complex interaction between data, theory and method embedded in a reflexive process, which supports the researcher moving from empirical data to theory and then back again in a dialectic, iterative and time-consuming process. Ongoing engagement with an evolving body of literature presented in Chapters 2, 5 and 6 served as further evidence of the potential mechanisms likely influencing events in the actual/empirical domains. The combination of these approaches supports 'judgemental rationality', where the researcher assesses and compares "the explanatory power of various theoretical

explanations" and then "selects theories which most accurately represent the 'domain of the real'", given the researcher's present knowledge (Hu, 2018, p.130).

The chosen case studies might be seen as having some limitations while representative of the original minimal selection criteria of location, school population and ICSEA, the number of schools might be viewed as a limitation. To put this into perspective, over 35 schools from two educational regions in Queensland were contacted, of which four agreed to take part in the research project[36]. As previously discussed, and despite each school being subject to similar structural conditions, each was a unique entity indicating the diversity possible even in a small sample. Accordingly, drawing any conclusions about potential mechanisms was increasingly complicated. Here, continuous engagement with literature served as both an additional evidence source of possible mechanisms and a critical understanding of the direction that research into data in education was taking. It is suggested that further research into schools in other regions would provide supplementary evidence of similar or different operating mechanisms, further developing the knowledge base.

To counter the implications of focussing on a smaller number of schools, data were collected from several points, the emphasis being on semi-structured interviews with people holding positions in each school site, and documentary evidence. This 'triangulation of data' could have been further supported by more involvement of the teachers in the study. However, given the time constraints imposed by school settings, this was not possible. The question of involvement is a curious one and given that participation in the study was voluntary, considering what might have prevented more active teacher engagement is interesting. Certainly, once the administration team from one of the larger urban schools was invested, there were indications that teacher participation would follow. However, following two rounds of invitations, only one teacher committed to an interview. The answer to this might easily be found in time constraints in a busy work environment or alternatively, a recognition of the power dynamics between administrators and teachers that might have further promoted a sense of surveillance. It does, however, suggest that a continuing research focus concerning the emergent social relations between administrators and teachers might provide further confirmation or otherwise of these research analyses and outcomes.

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[36] It should be noted that closing the recruitment process at four schools was part of the original methodology. However, the school recruitment process was time consuming and commitment was difficult to come by. During a phone conversation one principal suggested that her staff were already under considerable pressure and she did not feel she could add another task to their workload.

A further tension for some reading this thesis may be the way theory has been applied. An overview of the literature indicated ambiguities and disquiet concerning the significance of data in schools, the role of data governance, and the associated ontological and epistemological status of data in education. Here complex and emerging knowledge bases provided few 'new' methodological clues for studying the phenomenon. Rather than following some more well-worn educational research paths, this research adopted a broad CR critique that sought explanatory power in identifying mechanisms across different strata. Here, there is a sense of practical adequacy (Sayer, 1992), where better understandings might be generated, as Lipscomb (2014) argues, yet these are not guaranteed. Here, there are also assumed logical connections between ontic, epistemic and methodological understandings that must be appreciated if research is to remain coherent (Lipscomb, 2014). While these wide-ranging theoretical understandings might result in more plausible models for enquiry, it is this very broad nature that attracts criticism of CR as it focuses on the importance of ontology and the consequences that flow from ontological positions, with less of a methodological direction and position. This next section details some of these reservations as well as highlighting the strengths of a CR lens in educational research.

8.7 The Question of Methodology

Research into the impact of data in the social world and more specifically, how it is reshaping education is considered both crucial and challenging (Sellar, 2015; Selwyn, 2015; Williamson, 2016). Here it has been argued that the politics of data (Ruppert et al., 2017) need to be foregrounded, the social construction of educational data made visible and resistance to the 'face value' of data made the norm (Selwyn, 2015). Yet, educational research traditionally is characterised by "old divides" (Sellar, 2015, p. 774) and these 'lines drawn in the sand' may in part account for the result that the generation of evidence of impact has failed to keep pace with the growth of data infrastructures and accountability systems (Henig, 2013). Navigating this theoretical divide involves attending to and accounting for the relations between institutions, agendas, policies and practices, governance and finally, one's own research practices (Sellar, 2015). Consequently, the researcher is faced with the critical task of negotiating an increasingly complex and rapidly evolving research space. This work is largely reflexive with a view to improved understanding and a concurrent transformation of practice (Bhaskar et al., 2017).

Here CR provides a toolkit designed for the new social scientist in mind. In this respect, the researcher commits to seeing the world in particular ways. This research began with an intuitive reflection that acknowledged the 'realness' of mechanisms and structures that likely existed independent of the investigation into an education accountability policy. Bhaskar et al. (2017)

suggest that to be a realist "you need to think that *something* has happened, or that *something* is there; and that *something* has an existentially intransitive reality" (p. 42). Making this commitment to ontology requires the researcher to consider and reflect on fundamental questions about one's research position (and others') and accompanying methodological choices. Bhaskar et al. (2017) identify the following research positions that might guide the researcher to new and "improved understanding and self-understanding" (p. 43). These are specifically a structure-agency resolution, a commitment to a retroductive methodological approach and an interdisciplinary approach.

8.7.1 A Structure-Agency Resolution

Undertaking research in the social world directed attention to the various types of structure-agency relationships that can be known (Scott, 2013). The educational researcher coming to terms with these possibilities requires a robust methodological framework that might theorise the way that agents reproduce and transform structures, while structure (and culture) acts back on agents and presents them with a supporting or constraining context for their actions across time (Bhaskar et al., 2017). Archer's (1995) morphogenetic cycle presented as the most mature model affording a distinctive view on the interplay between structure, culture and agency over time. This research relied on Archer's central positioning of human interaction to explain changes in schools wrought by new uses of data.

8.7.2 A Retroductive Methodology

A commitment to CR also comes with a commitment to a retroductive methodology, which assumes that events are likely to be explained through recognising and theorising the causal powers and mechanisms that produce them. This movement between theories to identify the necessary conditions with the greater explanatory power is an invaluable but painstaking process. A retroductive methodology supports reviewing the way in which mechanisms interact with other mechanisms at different levels and in different contexts in concrete conditions (Danermark et al., 2002). This movement began with the concrete empirical phenomenon and then moved backwards towards the generative mechanisms in the search for explanatory purchase.

8.7.3 An Interdisciplinary Approach

In education, as in other fields, the importance of an interdisciplinary approach can be underemphasised, yet increasingly researchers recognise that to challenge emerging dominant data practices, an "ecology of practices" approach might support connections across the divergent practices that have grown around data (Sellar, 2015, p. 774). In Shipway's words:

CR's emphasis on interdisciplinarity in a genuine postfoundational, dialectical dialogue contrasts strongly with the recalcitrant, self-sustaining conflicts in many areas of educational research. Indeed an interdisciplinary focus may be the most significant contribution of CR to research in education (2011, p. 170).

For the novice researcher to begin to come to terms with the scope of how data are restructuring/reshaping education and the conditions of educational research (Sellar, 2015), CR offers the tools to frame and further develop boundaries and limitations around the research phenomenon and the researcher's research aspirations. This is a reflexive and sense-making exercise that permeates the entire research process. Foregrounding these concerns leads to the methodological questions earlier proposed.

Methodological domain questions:

- What are the advantages and challenges of a critical realist toolkit when researching data use in schools? And what are the broader implications of CR for educational research?
- How does the morphogenetic approach support research into agential transformation in education?

This thesis argues that CR supported the researcher's study in education on three levels. First, it provided a safe (and challenging) space for the researcher to develop some much-needed skills and alternative knowledge concerning social theory and the assumptions that CR researchers make about the nature of reality. In the second instance, it served to reinforce the utility of CR for explanatory critique, where CR can reveal the problems involved in the underlying structures and mechanisms of educational systems for emancipatory purposes (Shipway, 2011). Third, it considered the application of CR in the practical sense through the morphogenetic approach. Therefore, this reflection on the methodology applied here considered CR contributions from both a theoretical perspective and an applied/practical sense.

The critical realist toolkit offered the means to scaffold educational research in several fundamental ways. Recognising that the distinction between the domains of the real, the actual and the empirical supported "the belief that generative mechanisms in the world have causal powers which may or may not be exercised, but still exist independently of human cognition or the individual's ability to know them" (Scott & Bhaskar, 2015, p. 61). The depth-realism of CR supported a reconceptualisation of how data flows are constructing and enacting different forms of power and participation in educational theory and practice. Concerns about data are expressed

across these domains of reality while avoiding "the collapse of ontology and epistemology" (Lash, 2006, p. 581) that may characterise some empiricist representations of data in education.

Following Shipway (2011) at the level of the real, questions were asked of what data really are. This recognised that data are constructions about the world and, as such, they do not "represent the reality of the world independent of human thought" (Williamson, 2018, p. 10). At the level of the actual, questions are asked about what we can know from data, and because data is a thing that exists as events and phenomena, the effects of data can be considered and analysed. At the level of the empirical, data-use in schools is dependent on teacher beliefs and knowledge and the subsequent decisions they make and so can be questioned. This research thesis, therefore, serves to remind us that CR in practice genuinely offers an opportunity to consider how principals and teachers might be constrained by structures and mechanisms in the social world.

In considering the broader implications of CR for educational research, research attention is directed to the potential for teacher data agency or professionalism, as a form of teacher emancipation (Corson, 1998). The emphasis is on successfully challenging "oppressive power structures" so that the power relations within may be changed. Shipway (2011), following Corson (1998), argues that a shift from "coercive to collaborative power relations can help (principals and) teachers dialectically reshape the structures in which they operate, in turn, changing the nature of everyday interactions of the agents in the school" (p. 184). This research supports the notion that CR provides the tools to surface the differences between a reflective, evaluative and collegial agency and a professional subjectivity that participates in the emerging (data) power structures (Shipway, 2011).

Here CR directs research attention to the analytic distinction between structure and agency and the emergent nature of this interaction (Gable, 2011). Also, Archer's (1996) methodological refinement perceives culture interacting with agency in a similar way to structure by supplying directional guidance for agency. At this level of interaction (in the real), beyond the logical relationship between ideas, what is important is who holds the ideas and who around them can be persuaded to accept these ideas—this is "the world of socio-cultural interaction" (Case, 2013, p. 44). A key contribution here is Archer's realist social theory, which supports these stratified models of structure, culture and human agency over time. Archer provides the relational (macro, meso, and micro) connection that informs structural analysis and conceptual framing of change over time. Analytical dualism and analytical histories of emergence moved the argument contextually from the macro to the micro in a cohesive and largely coherent fashion. This process was not without its

constraints. The next section considers both the strengths and limitations of the morphogenetic approach.

In a pragmatic sense adopting the morphogenetic approach signalled a commitment to a methodology which gives oft-absent structure to CR philosophical underlabouring. Maton (2001) connects the "philosophical underpinnings, theoretical and methodological approaches and concrete empirical studies of research practice" (p. 58) and Archer's sparse characterisation of this process in the following way:

Social ontology ↔ Explanatory methodology ↔ Practical social theorising

He argues that an explanatory methodology is one that makes visible the relationship between ontology and empirical research. In this case, the theoretical and methodological frameworks of CR, while remaining consistent with realist principles, should also align with the practical application of empirical research in a disciplinary area, such as education (Maton, 2001). Crucially, critical realism served in this research "a (reciprocal) regulatory rather than substantive role with regard to educational disciplinary knowledge; therefore confirming critical realism as a necessary, but not sufficient condition for realist educational research" (Maton, 2001, p. 58).

Accordingly, Archer's practical (and extended) social theorising of CR seemed sufficient for the purposes of this research, as demonstrated in the preceding chapters. Regardless of its affordances in my research, it does come with a series of caveats. Specifically, a morphogenetic approach supports the modelling of social and cultural structures operating internally and externally to organisations and allows them to be distinguished. The mediating responses of agents to these structural and cultural conditions and the forms of social relations that emerge from these interactions can then be described (Lipscomb, 2014). However, it should be noted that Archer's high-level methodology does not offer much in the way of prescription, and while elegantly and intelligibly written, it can be dense in places. Accordingly, this research followed Archer's (1996) own injunction to "travel light" and to use only the amount of theory that is "necessary and sufficient" to make sense within the structure of the research (p. xi). In this respect, Archer's cautionary advice is avowed by Case (2013), who argues for an "economical approach" to terminology, which should be introduced only when necessary and to avoid acronyms as often as possible (p. 7).

In reviewing the problematic features of applying the morphogenetic approach (and CR in general), an initial concern remains— that of conceptualising and identifying mechanisms. This research was predicated on understanding the impact of data in schools and on teachers. In this

respect, it was a search for the mechanisms that were potentially emergent (as properties) from data structures and cultures and their subsequent interaction with people, each with "*their* own emergent powers of self and social reflection" (Archer, 1995, p. 175). Yet, identifying distinct outcomes in so complex a research context continued to constrain this research. This methodological challenge has been recognised by several researchers, who practically applied Archer's morphogenetic approach (Dobson et al., 2013; Horrocks, 2009; Lipscomb, 2014), and as Gable (2011) argues is not necessarily overcome by the application of a modified version of Pawson and Tilley's (1997) CM(A)O configurations. Here searching for "generative mechanisms in the choices people make and the capacities they derive from group memberships", positions the causal powers of people as the source of agency (Carter & New, 2004, p. 14). Still, as Pawson (2004) argues, there can be no expectation of mechanisms working consistently because their causal powers are always dependent on emergent agency and multiple contexts.

In the endeavour of aligning processes of abstraction with the search for causality, the obvious drawback is working with multiple perceived mechanisms across multiple educational contexts. Eventually, however, the outcomes of the research rely on making choices based upon a theoretical perspective, and here, it is recognised that different theoretical choices might lead to different research outcomes (Gable, 2011). This does not suggest that the outcomes of this research are less valid or valuable; only that it is recognised that the very process of abstraction brings forth some aspects of a phenomenon, while other aspects may remain in the background (Sayer, 1998). It does, however, suggest the value of applying another theoretical lens to this research space, which may result in further explanatory purchase in the future.

Further to this discussion, this research confirmed the value of a realist explanation via CMO configurations. The novice researcher engaged in data 'wrangling' could do worse than develop a series of CM(A)O configurations in the search for causality. This form of practical theory testing acknowledges the complexities of research into data use as a 'black box' and advocates a research logic that seeks a specified understanding of mechanisms, contextual conditions and outcome pattern predictions (Pawson & Tilley, 1997). Specifying agency (A) within the basic realist formula may prove confusing to those familiar with Pawson and Tilley (1997) realistic research processes, yet abstracting agency is a deliberate attempt to overcome some of the more under-socialised views of the possibilities of data agency or forms of data activism in schools (Milan & Van der Velden, 2016). This approach also directs attention to the possibilities of further work in this area where a different theoretical lens might direct attention to different research outcomes.

8.8 Contributions to the Ongoing Discussion of Data Use in Education

This research in this thesis contributes to knowledge by providing a broader contextual understanding of data use in education that presents a view that considers the relationship between the social and the systemic across several contexts (Archer, 1995). It addressed the call for further research into the significance of data within education and proposed trends that require investigation. Finally, it considered the possibilities of CR and the morphogenetic approach as theoretical and methodological models to unify research direction into data use and datafication in education.

8.8.1 The emergence of data use

Recent studies indicate the pressing need for understanding data as the "new cognitive space in education" (Lawn, 2013a, p. 10); yet, there is uncertainty as to where to position this research. A review of the literature indicated contested knowledge bases and inconsistencies in approaches. Significantly, the pervasiveness of data across regional and national education systems, the political significance of data governance and the scaling-up of data collection, even in very small schools, indicates the wide-ranging aspects of the phenomenon. This research has contributed to understanding data use in education by considering a broader perspective of the phenomenon that begins at the infrastructural system, moves through institutional settings and interpersonal relations at a school level, and finishes at an individual teacher level. Through this stratified representation, this research sought to explain/expose the "accumulated sense of constraints and enablements", structural and cultural that are imposed on differently situated agents and actors across these contextual strata (Herepath, Kitchener, & Waring, 2015, p. 157) by the rise of data in education systems. These macro-, meso- and micro-analyses present opportunities to contribute on several fronts although, it is noted again, that critical realism's approach to causation and a stratified reality support a form of generalisation that might make sense in only some circumstances.

8.8.2 Teacher data agency –Transformation and reproduction

The outcomes of this research surface the complex context of the social relations between data policy, teachers and schools in general. Each generative mechanism provides some insight into what appears to be working in each school case. However, what is missing is the acknowledgement of a more granular understanding of the "unequal agency that individuals and social groups might have when engaging with data" (Selwyn, 2015, p. 71). In this respect, the achievement of agency in this thesis is active engagement with data processes that are supported by professional learning and improved knowledge.

This research has begun this process by directing attention to the possibilities of a teacher data agency and how this might emerge. However, the researcher cannot avoid the issues of data-induced accountabilities and surveillance, where thinking about agency is actually an exercise in "thinking about the distribution of data power" (Kennedy, Poell, & Van Dijck, 2015, p. 2). Datafication is now, more than ever, enacted by the interplay between organisations, institutions, practices and social actors (Williamson, 2018). This dispersal of data control and influence results in a complicated landscape, which this research has attempted to describe. Yet, the research falls short of fully coming to grips with forms of data hierarchies that describe a new "data analysis divide" (Manovich, 2012, p. 461) between data experts and those with limited experience of data, which in turn might threaten the emergence of an equitable agency. Therefore, what might serve here is a more active and extensive enquiry into what teachers value about and what they *do* with data to surface the everyday uses of data from a social perspective (Couldry & Powell, 2014). Understanding these primary engagements with data might, in turn, shed light on the contextual practices that are performed "to make alternative data and narratives count" (Milan & Van der Velden, 2016, p. 69).

8.8.3 New ways of thinking about new ways of knowing

In this closing space, I want to address the contributions CR and social realism can make to research into data in education. The rise of data is changing what people know and how they know it in education and other spaces. Here it is reasoned that understanding this complex space warrants an evolving research agenda—one that by necessity should be interdisciplinary. Bowker, Baker, Millerand, and Ribes (2010) contend that data and infrastructure studies should not be fragmented into separate fields. They conclude that within information infrastructure as a new 'field', "the global and the local, the social and the technical are in flux in new and interesting ways" (Bowker et al., 2010, p. 112). This CR-focused research has attempted in several ways to capture the broad conceptualisation of this new space.

Through its recognition of the sociology of knowledge, this CR-focused research agenda can consider the influence of alternative epistemologies and the divisions in the knowledge base concerning data use in education. By problematising data in education and considering how data are being used to reshape educational practices, this CR research empirically opened up the study of different forms of data use and datafication to produce more constructive forms of professional knowledge.

Here, the CR view of a stratified understanding of reality also provides the means to consider data use and infrastructure across multiple perspectives and on multiple levels. This is imperative, argues Bowker et al. (2010), where:

> Each layer is riven through with each of these dimensions—and we need to train social scientists and information scientists to move freely between all of them. This is not just a good idea—it is something of a law if we want to fully understand emergent phenomena in the development of new ways of knowing.

(p. 113)

CR, therefore, supports explanatory purchase by drawing together a way of thinking that is equal to the scope of the broader aspiration of considering the rise of data use in education.

Additionally, through its analytical separation of structure, culture and agency and the emergent nature of this interaction, both CR and realist social theorising present a viable alternative to consider the shifting dimensions of school policy reforms. Specifically, the objective of identifying the social relations in need of transformation, reform or reproduction, this CR-focused research with its emancipatory focus has been shown to be a workable means of making sense of the relationship between people and society.

Finally, this research has demonstrated that the morphogenetic approach provides a suitable methodology to investigate the emergence of these complex social relationships in which data use and agency are embedded across multiple contexts in school systems. Accordingly, it is fitting that CR research offers an alternative methodological pathway to begin the rethink of the nature of data in education.

8.9 **Summary**

This research thesis established that understanding how data are being used in schools involved working across multiple strata (Sellar, 2017). Here, research and theory worked to link data to action and to examine the interconnected organisational and political contexts within which these data processes evolve (Coburn & Turner, 2011). It reinforced the crucial need to appreciate how data-use processes unfold across various levels of the educational system. By mapping emerging data policies, the implementation processes adopted by government and local agencies to operationalise them, and the resulting structural and cultural arrangements in schools that frame teachers' day-to-day data practices, a clearer picture of the conditions (Priestley et al., 2015b) that enabled or constrained teacher agency emerged.

A CR understanding of the stratified reality supported Archer's social realist analysis of identifying the significance of causal mechanisms that give rise to observed social phenomena of data in education. This perspective encourages examination of how data functions on multiple levels; it draws attention to the way data is reshaping education both globally and in the classroom. In summary conclusion, this thesis journey has traversed some distance both theoretically and methodologically; its conclusions (and constraints) suggest that there are many future opportunities to explore the impact of data use in schools.

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10. Appendices

Appendix A - Research question design and analysis

Research questions	Structure	Culture	Agency	Interview questions (sample)
RQ1. What pre-existing cultural and structural conditions influence the way data is used in schools?	Interpretations of those relations by relevant social actors (provides insight to the structural properties that position actors)	Interpretations of those relations by relevant social actors (provides insight to the cultural properties that position actors)	The intended and unintended consequences of actions – important dimension –activities designed with intention however have unintended consequences	In what circumstances do you work individually, with other teachers, with the principal? What external factors influence the way you work with data in the school? In what ways does the culture of the school influence the way you use data?
RQ2. What are the key dimensions of data use in schools?	Relations or structural properties at each time point- may or may not be activated, leading to understanding of context.	Relations or cultural properties at each time point- may or may not be activated, leading to understanding of context.	The intentions of social actors in the research setting at each time point- provide access to structural properties positioning actors.	Describe how you work with data in the school in general, in the classroom? What outside influences drive the use of data in your school? How is your work shaped by the data you use in the school? How is data visualised, brought to life in your school? Data talks, walks, walls and dialogues?
RQ3. How does engagement with data inform professional practice and teacher learning in school contexts?	Relations between different structures at each time point and context – the need to understand how each property operates at different times and in different contexts	Relations between different cultural influences at each time point and context– the need to understand how each property operates at different times and in different contexts	The subsequent effects of those intended and unintended actions on structural and cultural properties in each context – What happened and why? The need to assess effects.	What influences the types of data used? What shared understandings, responsibilities and beliefs do you have about data in your school? Do you utilise data as part of a larger process (a bigger picture?). Is there a democratic approach to the process of data use?
RQ4. How might data use constrain or enable principal-teacher agency within the school setting?	Perceived relations between different structures at each time point by the relevant social actors –possible access to real relations and social actors' perceptions of relations.	Perceived relations between different cultural influences at each time point by the relevant social actors- possible access to real relations and social actors' perceptions of relations.	The degree of structural/cultural influence and the degree of agential freedom for each human interaction	What do you think the rationale is behind developing social relations of data use? What are the drivers for data use? How do you engage with data with others? In what ways has your professional life been modified to include new relationships when using data in school? Are there any tensions around the social relations associated with data use in your school?

(following Scott, 2000, pp. 34-35)

Appendix B – Preliminary coding key components of data use

| Key components (Coburn and Turner, 2011)		Data use influences	Data	Possible structural arrangements
Interventions	Tools Comprehensive initiatives Accountability policies Reform based changes NAPLAN scores PISA scores	Designed routines	Direct from the domains in the National School Improvement Tool The domains are great, an explicit guidebook Schools have agency to make their own way, particularly IPS schools Discretional funding	Systematic plan for the collection of data School leaders design and implement data routines All staff engaged in data processes.
		Technological tools	OneSchool dashboard, Moodle, Blackboard, MySchool website Not everyone trained in the process Only single guru in school often	Upgrading teachers' skill analysing data Leadership team develops visualization tools (i.e., data walls)
		Protocols and skilled facilitation	Internal and externally facilitated School Performance Assessment Framework 2015 National School Improvement Tool Discipline audits School reviews Trained facilitators (principals) Training as auditor and review people Great professional development	School leaders design and implement data routines Upgrading teachers' skill analysing data Leadership team regularly presents data to staff Teachers respond to professional development All staff engaged in data processes.

			Professional development Professional learning environment	Internal and external Take the lead program Agency Coalition of the Willing The Freeway Coalition Teacher beliefs, teaching and reform-based changes Teacher beliefs as construct-like slow and fast thinking teachers rely on the model rather than the problem solving (Nespor, 1987)	Upgrading teachers' skill analysing data Leadership team regularly presents data to staff Whole school approach to data use Teachers respond to professional development All staff engaged in data processes. Teachers take part in regular small-group conversations around data
			Sanctions and rewards	Teacher standards, Pay performance, Career stages, Funding state, regional and school level Different stages of career may affect reaction to processes Teachers adapting as always	School leaders set aside time for comprehensive data conversations School leaders monitor and assist teachers to set targets Principals report school data to supervisors (ARDs)
			Systems of meaning Categories Classification systems Logics of action	Examples from UK/US Grattan report (2015)	Teachers contribute data to visualisation process

	Political Organizational	Relations of power and authority	Regional office- principal Principal- teacher DP -student Agency Increased intensity from ARD-SP. "I have this meeting with someone tomorrow morning."	Leadership team regularly presents data to staff Principals report school data to supervisors (ARDs)
		Access to PD	Master teacher and deputy HOC Support team, OT, ST, special needs Professional learning environment Professional learning community In-house PD Leadership support "I back my teachers"	Leadership team develops visualization tools (i.e., data walls)
		Data-use routines	Data mining Learning analytics Data talks Data conversations Data walks Peer to peer	Specialist school groups meet regularly and discuss data Teachers contribute data to visualisation process Teachers take part in regular small-group conversations around data
Context		Time	4-year cycle MT 3-year contact Limited	Whole school approach to data use All staff engaged in data processes.

				Intensity rising Swamped 'Perfect storm' comment	
			Availability of data	Primary traces Initial data conversation tool Student records OneSchool MySchool	Specialist school groups meet regularly and discuss data Expanded data set drive new forms of interaction Teachers contribute data to visualisation process Teachers engage with visualisation processes
			Norms of interaction	Data talks Data conversations Data walks Even data talks with students (not in every school). Principal (coalitions) Cohort groups Staff meetings	Specialist school groups meet regularly and discuss data All staff engaged in data processes. Teachers take part in regular small-group conversations around data Teachers engage with visualisation processes Principals report data to supervisors (ARDs)
			Leadership: hierarchical, distributed, flattened	Master teachers, head of curriculum Deputies, data mentors Seems to be a data guru. He got the job because of his skills with data.	Principal adopts leadership text/philosophy/ ideational Teachers take part in regular small-group conversations around data Principals report data to supervisors (ARDs)

		Institutional aspirations	Funding requirements rewards, Great Results Guarantee DETE funding Raising points on NAPLAN Raising individual's scores Measuring success by improvement not by best scores. No red, only green What do you do when it is all red or all green? Individual differentiation of student. This student has scored this in NAPLAN and two years she hasn't shifted. Even though she is high already we haven't moved her at all. We have done nothing for this student.	Data collected about all aspects of school life
Practices of data use	Noticing – primary traces Interpreting Constructing implications Action	Beliefs and knowledge Cultural understandings	Visualisation of data Data records Professional development Data profiles Individual schools creating templates for conversations. Can be used for accountability as well.	Professional learning opportunities recognised and undertaken Teachers contribute data to visualisation process Teachers take part in regular small-group conversations around data Teachers engage with visualisation processes
		Motivation	Data you can trust Accountability Professionalism and professional judgement Building in the teachers the ability to trust the data.	Teachers taking part in regular data routines Teachers respond to professional development

		Social interaction – social relations	Emergence Improvement?	Teachers take part in target-setting conversations based on student achievement data
Outcomes	Organizational change Change in practice Student learning	State, regional, school and classroom level Commensuration practice	Data overload Data inertia Narrow focus of attention Curriculum narrows or becomes too wide Tension and stress Metro vs rural Aspirations Too much red Targeted teaching	Teachers take part in comprehensive data conversations Teachers respond to professional development All staff engaged in data processes.

Appendix C- Data use emergent properties
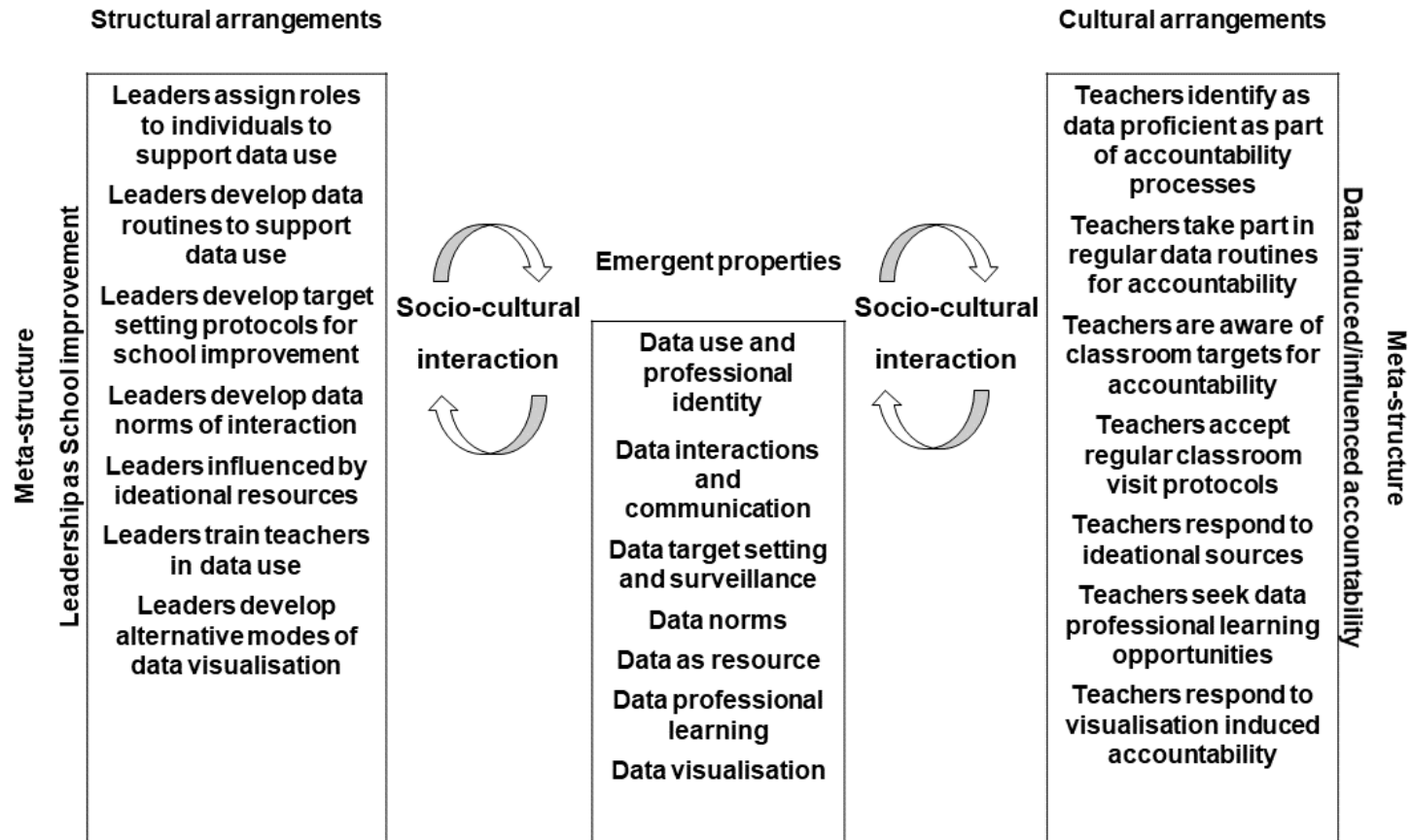
Socio-cultural interaction and identification of emergent structures (adapted from Gable, 2011, p. 172; Wallace & Priestley, 2011)

Structural and cultural arrangements	
Leadership and school improvement	Data-induced accountability
Systematic plan for the collection of data	Data collected about all aspects of school life
Upgrading teachers' skill analysing data	Professional learning opportunities recognised and undertaken
School leaders design and implement data routines	Teachers taking part in regular data routines
School leaders monitor and assist teachers to set targets	Teachers take part in target-setting conversations based on student achievement data
School leaders set aside time for comprehensive data conversations	Teachers take part in comprehensive data conversations
Principals report school data to supervisors (ARDs)	Principals report data to supervisors (ARDs)
Leadership team regularly presents data to staff	Teachers engage with visualisation processes
Leadership team develops visualization tools (i.e., data walls)	Teachers contribute data to visualisation process
Specialist school groups meet regularly and discuss data	Teachers take part in regular small-group conversations around data
Whole school approach to data use	All staff engaged in data processes.
Principal adopts leadership text/philosophy/ ideational	Teachers respond to professional development

EMs	Data abstractions	EMs	Data abstractions
Data use and professional identity	Principal adopts leadership text/philosophy/ ideational Schools are about relationships Principals rely on external support networks Specialist teachers have expert knowledge about data and new educational practices Master teachers are users and contributors to research Principals apply an explicit school improvement agenda Principals are instructional leaders Data is just part of constant systemic change Whole school approach to data use Data as part of workload Data is used to inform pedagogy Principals manage multiple relationships Data use is a whole school process Data is valued for its usefulness Teaching is far more demanding now Data confirms what teachers already know Data underpins school improvement Teachers have a professional understanding of student progress Data will help improve teaching Data are part of systemic improvement Teachers see master teacher role is to analyse data and present it back to staff Data confirms teacher understanding Data is seen to provide proof of teachers' knowledge Data work is time consuming Teachers rely on leadership team to guide and direct through data Teachers display data agency Principals believe in the purposeful use of data Principals influenced by ideational resources	Data-interaction communication	School leaders design and implement data routines Leadership team regularly presents data to staff Specialist school groups meet regularly and discuss data Teachers build relationships with each other Principals build relationships with teachers and teacher aides Principals facilitate formal and informal data talks with teachers Specialist teachers assist classroom teachers to improve data practice Data is used to make conversations Principals manage multiple relationships Data use is a whole school process Leadership team support professional conversations about data Teachers use data to take part in professional learning conversations Teachers are expected to work in teams Data processes are seen as time consuming Teachers need a common terminology with which to discuss data and improvement Teachers take part in data conversations and talks for improvement Teachers believe in effective communication All staff engaged in data processes. Teachers develop a shared understanding of best practice with other teachers Teachers take part in regular small group conversations around data Teachers take part in comprehensive data conversations

	Principals apply a continuous improvement cycle Principals meet data expectations Teaching is a heavy workload Teachers believe in the authenticity of the data Schools are open and transparent organisational cultures Education outcomes improving not understanding why? Teachers demonstrate high professional standards Teachers have high quality expectations of themselves and other teachers Teachers hold themselves responsible for student outcomes Teacher aides provide important support and aid in the classroom Professional learning opportunities recognised and undertaken Teachers take part in whole school pedagogical improvement		
Data and professional learning	Upgrading teachers' skill analysing data Principals build professional learning communities Specialist teachers have expert knowledge about data and new educational practices Master teachers are users and contributors to research Specialist teachers assist classroom teachers to improve data practice Teachers should be improving their data skills Teachers should be constantly improving their teaching practices Teachers need to understand the why? Data is valued for its usefulness Data confirms what teachers already know Teachers see master teacher role is to analyse data and present it back to staff Teachers utilise data professional learning Teachers need to improve their knowledge base	**Data as resource**	Systematic plan for the collection of data Principals rely on funding resources to employ more data and improvement specialists Principals increasingly use data infrastructure Schools increasingly rely on data infrastructure Data helps to differentiate Follow the data for explicit teaching Data used to track students' progress Data provides some baselines to work from Data is used to inform pedagogy Data is valued for its usefulness Prioritising important data to help us teach Data confirms what teachers already know Data underpins school improvement Data will help improve teaching Teachers see master teacher role is to analyse data and present it back to staff Data collected about all aspects of school life

|			
	Teachers need a common terminology with which to discuss data and improvement Teachers take part in whole school pedagogical improvement Teachers respond to professional development Professional learning opportunities recognised and undertaken		Teachers rely on data infrastructure
Target setting and surveillance	School leaders monitor and assist teachers to set targets School leaders set aside time for comprehensive data conversations Principals report school data to supervisors (ARDs) Data used to track students' progress Data provides some baselines to work from Prioritising important data to help us teach Data underpins school improvement Data are part of systemic improvement Data serving as evidence of a school's achievement Teachers are expected to work in teams Data supports accountability for every student Teachers are under pressure to improve outcomes Principals are under pressure to improve outcomes and meet data expectations Teachers are subject to increased surveillance Principals are under increased surveillance Principals are subject to increases accountability policies Principals meet data expectations Principals report data to supervisors (ARD-SPs) Teachers take part in target setting conversations based on student achievement data	**Data norms**	Leadership team regularly presents data to staff Principals increasing use data infrastructure Data is just part of constant systemic change Data as part of workload Data use is a whole school process Data are part of systemic improvement Teachers rely on leadership team to guide and direct Data processes are seen as time consuming Teaching is a heavy workload All staff engaged in data processes. Data collected about all aspects of school life Teachers taking part in regular data routines Teacher aides provide important support and aid in the classroom

Data visualisation	Leadership team develops visualisation tools (i.e., data walls)		
	Principals support data visualisation on a number of levels from excel spreadsheets to data walls		
	Teachers engage with visualisation processes		
	Teachers contribute data to visualisation process		
	Teachers utilise data walls in their target-setting for students		
	OneSchool dashboard used to inform decision making and target setting		

Appendix F – Context, mechanism, agency and outcome configuration table

Context	+	Mechanism + Agency	=	Outcomes
C_1	+	$M_1 + A_1$	=	O_1
C_2	+	$M_2 + A_2$	=	O_2
C_3	+	$M_3 + A_3$	=	O_3
C_N	+	$M_N + A_N$	=	O_N

(adapted from Pawson and Tilley, 1997)

Appendix G- Timeline development of audit and review processes Queensland 2008 -2017

THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA
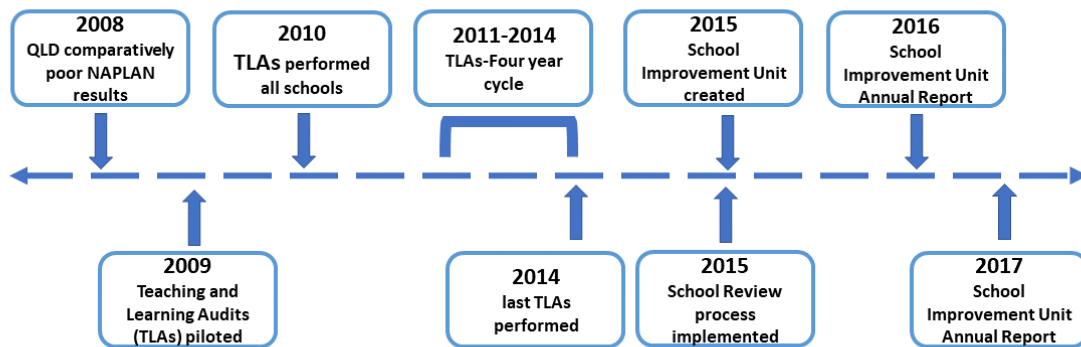
The School of Education
GRICOS PROVIDER NUMBER 00025B

12 March 2015

Karen Sheppard
School of Education

Email: k.sheppard@uq.edu.au

S/N: 43116467

Ethical Clearance Number: 14-028-B

Dear Karen,

I am pleased to advise that on the 12th of March 2015, ethical clearance was granted for your project "Interacting with data: Shifting social relations in schools".

I would also like to remind you that any correspondence associated with your project (consent forms, information sheets etc.) must be printed on official UQ letterhead (available from the School of Education Front Office).

It is important that the School of Education receives for our records a final copy of all Information Letters and Consent forms.

If you have any questions regarding this matter please do not hesitate to contact me.

I wish you well with your studies.

Yours sincerely,

Michelle Weston
Senior Administrative Officer
(Research Higher Degrees)