Lyn Yates · Peter Woelert
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Knowledge at the Crossroads?

Physics and History in the Changing World of Schools and Universities

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Preface

This book originated in a research project that set out to use a study of history and physics in Australia today to examine two important sets of questions. The first set of questions is about knowledge and the content and structure of the curriculum of schools and universities. What value do traditional studies such as history and physics have in the changing world and knowledge fields of the twenty-first century? How have fields like history and physics changed? What do those who work in these fields see as important in their teaching and research activities? The second set of questions is about the changing policy environment and the management of schools and universities today. How are changes of governance affecting the knowledge work of schools and universities?

The project itself was built on an earlier research project that had studied changing thinking about the school curriculum around Australia over the past half century. This had found considerable upheaval among curriculum leaders and policy-makers about what should ground curriculum today, how it should be structured, what should be emphasised. Should this be learning, or standards, or skills, or capabilities? Where does knowledge come from? Which school subjects should have priority? How to avoid an over-crowded curriculum?

From the other end the project was built on our experiences of working in the research environment of Australian universities, including in a senior management role. Here other questions were apparent. What is specific to different fields of knowledge, and how are they impacted by priorities of funding bodies and university management? What impact do the curriculum reforms taking place in undergraduate teaching have on research agendas and research quality? How are universities and academics dealing with a knowledge explosion, demands for impact, preferences for collaboration or interdisciplinarity and ever greater scrutiny of research productivity?

Both the school curriculum questions, and the knowledge production and university management questions have been the subject of a lot of attention in the academic literature as well as on the ground. In this book, we use interviews with over 100 teachers and academics working in two important disciplinary fields to take a fresh look at what is happening now, and to take up the academic literature

and arguments about knowledge and about what matters going forward. The design of the study lets us keep in view what is similar and different about these forms of knowledge drawn from the humanities/social sciences on the one hand, and the sciences on the other. And it lets us see and think about the role of formal education institutions, across the trajectory from secondary school to the undergraduate years to research training and research.

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We wish to thank the many teachers and academics across the country who generously gave their time for interviews and feedback on the work in progress. In the course of the project, we valued the research assistance given by Dr. Huong Nguyen, especially in the preparation and searching of transcripts using Nvivo. Additional research assistance support was provided by Kerrie Delves and Elizabeth King. In the writing stage, we thank Glenn Savage, David Goodman, Maurice Toscano and Julie McLeod who read and gave advice on some particular chapters.

The project benefited by a two-day colloquium on *The Structuring of Knowledge Across School and Higher Education* held at the University of Melbourne in July 2013 focused on the work in progress. We warmly appreciate the contributions made at this event by Prof. Michael Young (Institute of Education, University College London), Prof. Lesley Farrell (University of Melbourne); Prof. Joe Muller (University of Capetown) and Prof. Terri Seddon (Australian Catholic University) and their ongoing interest in and discussion of the research and ideas discussed in this book. Lyn Yates further benefited by funded periods of discussion with researchers at University of Capetown (courtesy of an A.W. Mellon fellowship) and at the University of Oslo with the HEIK (Higher Education) and the curriculum (CLEG) research groups, and she thanks the Dean, Prof. Berit Karseth and Prof. Peter Maasen (leader of the HEIK group) for arranging and facilitating these visits. In the later stages of the project, our discussions were enriched by a series of discussions in Melbourne with a large cohort of

researchers from the University of Oslo working on related but different projects in higher education, led by Prof. Peter Maassen and Prof. Monika Nerland.

The authors want to acknowledge support from families and friends over the course of the project, in particular as we collectively produced two new babies during this time. In this context, Kate would like to thank her family for supporting her work at this time, particularly her partner Jon and parents Liz and Liam. Vic would also like to thank her partner James, parents Malcolm and Judy and parents-in-law Peter and Rhonda for their continued support.

Finally throughout the project we have had the good fortune to be situated among colleagues who consistently stimulate and challenge the work that we do and whose company we much value—thank you to all on level 7 of MGSE (Education Policy, Equity and Identity domain and the Social Transformations and Education research hub).

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Contents

Acronyms

ACARA	Australian Curriculum Assessment and Reporting Authority
AHA	Australian Historical Association
AIP	Australian Institute of Physics
ALTC	Australian Learning and Teaching Council
ARC	Australian Research Council
ATAR	Australian Tertiary Admission Rank
AUQA	Australian Universities Quality Agency
CAE	Colleges of Advanced Education
CERN	Conseil Européen pour la Recherche Nucléaire (European Organisation for Nuclear Research)
CTEC	Commonwealth Tertiary Education Commission
ERA	Excellence in Research for Australia (Australia's national research assessment program)
FOR	Field of Research (discipline-based classification system used by Australian Bureau of Statistics and Australian Research Council)
Go8	Group of Eight (Australia's elite research-intensive universities)
HASS	Humanities and Social Sciences
HERDC	Higher Education Research Data Collection
HSC	Higher School Certificate
KPI	Key Performance Indicators
MOOC	Massive Open Online Course
NAPLAN	National Assessment Program—Literacy and Numeracy
NPM	New Public Management
NSW	New South Wales (largest Australian state)
OECD	Organisation for Economic Cooperation and Development
Ph.D.	Doctor of Philosophy
PISA	Programme for International Student Assessment
SKA	Square Kilometre Array (large-scale physics research project)
STEM	Science, Technology, Engineering and Mathematics

TAFE	Technical and Further Education
TEQSA	Tertiary Education Quality Standards Agency
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNS	Unified National System
VCE	Victorian Certificate of Education

Part I
Introduction

Chapter 1
Researching the Changing World of Education

A Google search today brings up 2.3 billion links for the question 'what is education for?' The purposes, content and structure of schools and universities are very much in question. The rise of new and vastly different technologies and technological capacity; the reality of global communication, mobility, flows of population, global benchmarking and competition for students and jobs; the breakthroughs and 'knowledge explosion' in traditional fields, and the rise of new talk about 21st century skills and new forms of research collaborations to tackle 'wicked problems', are all widely evident. Harvard and many other universities now send their students to gain experience in different parts of the world. Across countries of the European Union, or in Australia or in countries of Asia, many previously tradition-bound universities make radical reforms to the undergraduate curriculum structure. And in school curriculum, most countries have introduced major reviews and reforms, not just once but repeatedly, over the past two decades. The curriculum literature itself is rife with major debates: 'reinventing the curriculum', 'bringing knowledge back in', '21st century skills and competencies'. The literature on universities also evidences major rifts, debates, dilemmas: should university teaching as we know it be replaced by online forms of learning? What is the purpose of undergraduate education? What forms of specialisation are needed? To what extent should research problems be built from 'national priorities' and collaborations with industry, rather than from within a more self-contained academic discourse?

In both universities and schools these changes and debates flag important questions about knowledge in the context of education, and about the governance, management and steering of education. These are the focus of this book and the research project on which it is based. In the sociological research literature education policy studies and curriculum studies have usually been considered as separate arenas of theory and practice (Rizvi and Lingard 2010). In what follows, we try to keep both kinds of study in focus. The curriculum inquiry question this project takes up is 'how should we think about knowledge today?' (Bok 2006;

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Karseth 2008; Tuomi-Gröhn and Engeström 2003; Yates and Young 2010; Young 2008). The education policy and strategy question the project takes up is: 'is the emphasis on learning outcomes and on auditing and managing education achievements in schooling and higher education distorting and undermining knowledge-building?' (Baert and Shipman 2005; Lamont 2009; Minelli et al. 2006; Power 1997, 2003; Shore 2008).

In 2011, the authors of this book set out to take a fresh look at these questions by embarking on a substantial research project with a relatively tight focus, one that we hoped would give some interesting close-up and bottom-up empirical evidence about changes in the work and work contexts of teachers and researchers, but that would also provide a springboard for returning to some of these big questions about knowledge and the role of formal education both in schools and universities. Our interest was in knowledge, knowledge building, and the changing institutional, policy and management contexts of those who are the knowledge workers. And our decision was to focus in this project not on the new entities—the various 21st century skills projects that are infiltrating the work of schools and the OECD, the interdisciplinary research institutes tackling grand challenges that dominate university website pages—but on two disciplinary fields that had long been considered core enabling foundations of education in both school and university, namely physics and history. Here we might hope to see something about what is changing in the contexts and forms of knowledge of the past, and to revisit through this lens the debates about foundations and what matters today.

The interviews, institutional settings and policy context we draw on in this book are located in Australia. In later chapters we discuss some of the specificities of this context, and we draw attention to particular concerns and emphases that are distinctive in this country (for example the particular form in which history has been drawn into public debates about Australian identity; and the extent and particular form in which centralised, quantified and high stakes measures are important in research funding and assessment). But the broad themes we pursue here have a strong international presence, and in the final chapters we touch again on these so-called global trends as well as the national specificities that are part of these.

In relation to knowledge in the 21st century (the literature of which is discussed in more detail in Chaps. 2 and 3 of this book), a core question which we focus on in this book is the extent to which older forms of disciplinary organisation and teaching need to be protected, reframed or overturned in the face of the knowledge explosion, new technologies, new global communications and relationships. In recent times, for example, much curriculum policy foregrounds the concern with what kind of world we are now in, and the capabilities required for that world (e.g. Dawkins 2009; Reid 2009). But another prominent debate (by Young 2008, Muller 2000 and others, drawing on earlier work by Bernstein 1996), argues that this outcomes-based focus has led to some fundamental weakening of the foundations of education, that it fails to take seriously the distinct role of formal education (as compared with broader socialisation), and undervalues the importance and specificity of disciplines such as chemistry, physics, history and the like. These forms

of disciplinary knowledge, it is argued, were socially created, but developed over time in a way that gives a particular kind of more objective and powerful knowledge, different from common-sense knowledge, and not simply aligned with social interests of the elite. A public version of this thinking is somewhat evident in the critical public and media campaigns in Australia that rejected the 'essential learnings' curricula in some states, and that paved the way for the National Curriculum Board (later the Australian Curriculum and Assessment Authority [ACARA]) which, initially at least, seemed to exemplify a new disciplinarity in its orientations to the role of schooling.

In higher education, institutions and governments are struggling with two parallel and overlapping concerns. One concerns the extent to which the content of the learning should be derived from what matters in the world now (big problems, 'grand challenges', workplace competencies and the like) or, conversely, whether moves in this direction tend to hollow out the learning. A second concern is with the implications of the rapidly changing forms that disciplines themselves are taking, the creative cross-fertilisation between fields that is creating new knowledge; and the prominence of big collaborative teams in leading research projects today. Approaching knowledge change through this lens generally recognises that there are both practical and conceptual questions about at what point interdisciplinarity is most usefully developed, and what kinds of 'foundations' are relevant to maintaining the sharpness and creativity of the future research.

So there are issues about how knowledge today is changing and also issues about what kind of education and training over time is needed. This ambivalence about what is to be nurtured is evident in national higher education policies themselves, with many programs explicitly encouraging innovative and cross-disciplinary work and non disciplinary-based 'graduate attributes'; while Australia's national research assessment program ERA (Excellence in Research for Australia) and indeed government funding of different elements of universities, assumes the continuing foundational nature of disciplinary units of more traditional types. And in schools it is evident in the swing between concerns with 'the basics' and 'standards' on the one hand and on the fears about a quite different world in the 20th century and the need to put more of the focus on flexibility, working in teams and the like.

Disciplines such as physics and history themselves are not static, and by approaching questions about change through those working in these fields, we thought we might capture something interesting about knowledge work. The historians and physicists and history and science teachers we interview have been formed by and continue to be involved in their own disciplinary intellectual fields in the form of networks and journals and associations, the intellectual disciplinary history of their field, the boundaries and identifications associated with these fields. But these knowledge workers are also employed in present day schools and universities, and the changing environments, agendas and horizontal associations these entail. We wanted to see how physicists and historians (and science and history teachers) see their agendas and practices as teachers and researchers today—how much they are part of and advocates for a disciplinary orientation, and how

much in their work of 'knowledge building' they are engaged with and enthusiastic about new forms of association that are cross-discipline rather than within-discipline. Through our interviews we aimed to see what purposes they are oriented to in their teaching and research activities, and how they see their own work in the context of the education life-cycle, and the context of other developments that are important today. This would let us return to some of the questions about new forms of knowledge and collaboration that are much discussed today. It would also allow us to keep in sight a comparative focus on science and on humanities or social science as forms of knowledge.

In relation to policy and management issues (discussed further in relation to literature and the Australian context in Chaps. 4 and 5 of this book), the backdrop to this study is the new kinds of belief about processes required to optimise quality in education, and the effects of permeation of education systems globally by what has been called New Public Management or an 'audit' culture (Baert and Shipman 2005; Karseth 2006, 2008; Marginson 2007; Power 1997; Rizvi and Lingard 2010). As Karseth and Sivesind (2010, 109) note in relation to school curriculum, 'organisations like OECD advocate a new political technology where formalised curriculum-making is ignored or even contested in favour of assessment and accountability systems.' An 'audit' culture is one where institutions are publicly scrutinised in terms of process and quantified results; and New Public Management is an approach which sees ongoing measurement and benchmarking as the means by which progress and quality will be driven (these concepts are discussed further in Chap. 4). In Australian schooling policies, the widespread appeal to PISA data, the prominence given to public assessment and reporting via NAPLAN (the National Assessment Program—Literacy and Numeracy), the increasing amount of data of all kinds that are being collected about schools by governments are part of this mind-set (exemplified in Dawkins 2009). In the case of universities, output measures such as course completion times and national research assessments are all part of this culture.

In relation to the interests of this project in what is happening to knowledge in education, the accounting culture has produced strong interventions into the work of schools and universities and a policy context very different to that of the mid-20th century. These institutions now have a particular concern with 'learning outcomes' rather than the content of the education experience; and learning outcomes are normally expressed in ways that have an instrumental thrust, and that need to be expressed as numbers. Moreover this data-collection is ongoing, and is tied to funding mechanisms, and to performance assessments for teachers and lecturers, so it potentially acquires some new primacy in how they direct their own work with students and in what they begin to attend to in building new knowledge (Baert and Shipman 2005; Hodkinson 2008; Karseth 2006; Marginson 2007; Minelli et al. 2006; Shore 2008; Rizvi and Lingard 2010).

The three year research project was funded by the Australian Research Council, and was named *Knowledge Building in Schooling and Higher Education: policy strategies and effects*. In the course of this project we carried out lengthy interviews with 115 people working in different kinds of institutions and roles across

three Australian states. Interviewees were selected to encompass much of the diversity that might be seen among physics and history teachers and researchers in Australia: some working in academic and elite environments (both school and university) and some in more comprehensive or disadvantaged settings; some who were highly successful, leading their national bodies, consulted on government reviews, heading their departments, and others who were just entering the field, having a casual foothold, or having had mixed experiences of building their career in that field. (A further discussion of the methodology of the project is included in the appendix along with our interview protocols.)

In semi-structured and open-ended interviews we sought to capture new empirical data and insights on a number of issues. Our primary focus was an interest in 'disciplines'—and change. Here we were interested in what both the overarching policy documents and the interviewees are expressing about their conceptions of knowledge. What forms of disciplinarity, cross-disciplinarity and capabilities orientations are evident in Australian policy documents in relation to secondary schooling, to undergraduate university education, and to postgraduate education? How do teachers, lecturers and supervisors working in history and in physics think about knowledge and what they are attempting to achieve in their practice in particular areas? What, if anything, is changing about this?

A second focus was the effects of the current forms of policy and management of schools and universities in Australia, in so far as this impacts on the knowledge work of these institutions. Here we ask, how are the assessment and auditing or accountability demands and practices shaping what is now being enacted as curriculum in schools and in higher education?

And a third interest was in the education and research training spectrum: what do we see that is similar and different in terms of purposes and concerns as we look across senior secondary school through undergraduate and research training, and across more and less elite/advantaged settings. How do those we interview think about this spectrum and education development across the education life-cycle?

Disciplines are social entities in their origins and interests, and in their professional associations, journals, communications and the identities of those who work in them; but disciplines are also ways of delineating, focusing on and building knowledge over time, of developing understandings of the world and ways of further researching it that extend beyond the individuals or social entities that make up the field. One of the key recent debates in relation to school curriculum and undergraduate curriculum is whether student learning runs the risk of becoming more superficial, less powerful, if it abandons some strong attention to induction into these forms of inquiry that have built over time, in favour of a flatter or outward problem-focused perspective that treats the world as composed only of problems in the everyday world, and information and techniques for dealing with these. In practical terms the questions here pose themselves for schools in terms of what kind of relative emphasis should be given to 'subjects' compared with 'competencies' or 'capabilities'—what should be driving practices, and timetabling, what should be the focus of assessment? In universities a related practical

issue is 'what are the gains and losses of moving to an organisational structure that de-emphasises disciplinary departments?' or of developing course offerings that mainly work backwards from what university leaders think the student market will choose? In the research environment, questions about disciplinarity and new forms of knowledge translate into questions about 'how can research performance be assessed?' (i.e. What role does a 'disciplinary' community have in this? Is such a community important or merely a historical artefact that is now needing serious change? Should meta-assessments and benchmarking replace judgements within the field?).

The contemporary rhetoric of university policy and management (at least in Australia) often suggests that 'disciplines' are static and backward looking, and that innovation is necessarily cross-disciplinary or interdisciplinary. But disciplines themselves are not static: their boundaries and techniques change, new disciplines or discipline-like fields emerge. And cross-disciplinary and inter-disciplinary work by definition is built on disciplinarity (though other possibilities exist).

So in our interviews we asked participants (with minor variations for school and university, see the appendix for further details) to talk about their perspective on some relevant questions: What do they see as characterising their discipline? What has changed in their perspective on the discipline since they first studied it? Do they do interdisciplinary or cross-curriculum work? What is their experience of these? Do they describe themselves (identify) as a historian or as a physicist? How do they see their discipline or subject relative to current concerns about relevance and capability and employability? What kinds of projects do they work on? What do they value in their knowledge work?

Our approach here is one particular way of entering the debates about the value of disciplinary structuring of curriculum compared with a de-emphasis on that. And it is also a way of revisiting and rethinking the past literature about disciplines and disciplinary communities with specific regard to current times. We chose history and physics because these are such emblematic subjects of the sciences and humanities disciplines, and there has been a lot of previous writing by educationists and sociologists of knowledge about the different knowledge forms that these fields represent (e.g. Becher and Trowler 2001; Maton 2009; Muller 2009). Science disciplines such as physics are often seen as archetypally 'vertical' or 'hierarchical' in their learning needs. Certain things need to be learnt and mastered first before other types of knowledge work within the field can be done. Paradigm consensus and testing and refinement of existing theory are important. Disciplines like history have been seen as having a different kind of form, where refinement and expertise is built in a different kind of way. Normative issues and social change and the questions and movements this generates are part of their formulations; the importance of evidence and ways of testing or respecting evidence may have broad agreement, but some ongoing presence of paradigm differences and contested interpretive accounts are normal within the discipline.

So, how far do these characterisations still hold in relation to recently reworked school and undergraduate curriculum? How are physics and history each impacted

on by new policy forms that require some degree of common template? The current 'Australian Curriculum' (the first national curriculum for Australian schooling) required each year level in all subjects to be set out in terms of a number of common formulations, for example to identify what will be further developed at that level compared with the earlier one, or to reflect certain capabilities and 'cross curriculum priorities'. How does this vertical development and cross-curriculum template impact on what is taught as history and how teachers orient to history teaching? How do the cross-curriculum competencies and priorities influence what teachers are required to do and think about and convey as science, as physics? And at university, if historical knowledge and physics knowledge have different structural forms, how do the new management templates for judging research quality and research achievements affect the work of those who work in those fields?

In designing our study around interviews, we wanted to keep in view both the discipline (an abstract conception that includes the knowledge and inquiry processes, the journals and other publications, the conferences, activities and history of the field) and the person in the discipline (the person engaged in reproducing or rebuilding the discipline through their teaching and research), a person whose working life and agendas is not only framed by their disciplinary associations but by their working environment as teachers and academics. One of the things that is characteristic of recent university management (national and local) is a greater interest in steering and managing and making judgements about quality from outside the disciplinary community. But this does not mean that peer judgement has disappeared or is not also important. So how do historians and physicists understand these different aspects of their working environment, the criteria by which their work will be judged, the aspirations they have for their work? How do they think about what matters in their work today? And how are teachers of particular subjects in schools (science, history) impacted in the knowledge work itself by the broader settings in which they now work?

In Australia, the national curriculum body ACARA has a brief that covers curriculum, assessment and reporting. The national testing and data-base approach to displaying the value of what schools do is highlighted in the form of a publicly promoted *My School* website that aims to show the comparative performance of each school. The data here encompasses the national numeracy and literacy testing, and the final year 12 results and student destinations—but it is not built on testing what is being achieved in history and physics. So how are these subjects impacted by student subject choices and the individual and school gaming that are part of the NAPLAN comparisons, and the high stakes final school certificate in Australia?

Undertaking a study whose empirical focus ranges across secondary school, undergraduate teaching, research training and research itself is somewhat unusual. In doing this we become more aware than is often the case of how some common developments and concerns (about knowledge, the changing world, a market philosophy, approaches to management) are entering these different phases of the education spectrum, and are able to think about some of the effects and scale of the kinds of changes in train. At the same time our focus across the different stages

of the education spectrum allows us to think again about the purposes and specificities of each stage: for example the cultural significance of what is required in the compulsory stages of schooling. Similarly, looking at undergraduate education in the context both of schooling and of research agendas shows some of its distinctive tensions. Today this phase is both a phase of mass education, preparing students for a range of future jobs and also, for future researchers, the beginnings of the foundational work for the research and innovation activities which have become more important to contemporary universities than they once were.

So in this book we aim to bring together new empirical accounts of what is happening in Australian schools and universities today, and to revisit and hold in comparative view two major disciplines of knowledge: physics and history. The study arises from some conceptual questioning about knowledge work and about the directions of education institutions. It engages with and aims to contribute to the contemporary literature on curriculum, sociology of knowledge, disciplines, and the policy and management of schools and universities.

The book begins in this opening section with a more detailed account of the literature we have flagged in this introduction (on knowledge, change, and institutional management), and on the Australian context in which our study is set. We then in two sections look in some detail at our research findings, first in relation to schools, then in relation to universities. In the final section of the book we return to our findings and these major questions to reflect in three chapters on schools, universities, the disciplines of physics and history and the big questions about 'knowledge building' today.

References

Baert, P., & Shipman, A. (2005). University under siege? Trust and accountability in the contemporary academy. *European Societies, 7*(1), 157–185.

Becher, T., & Trowler, P. (2001). *Academic tribes and territories: Intellectual enquiry and the culture of disciplines*. Buckingham, UK: SRHE and Open University Press.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor and Francis.

Bok, D. (2006). *Our under achieving colleges: A candid look at how much students learn and why they should be learning more*. Princeton: Princeton University Press.

Dawkins, P. (2009). *Improving educational outcomes in Victoria.* Public lecture presented as part of the MGSE Dean's Lecture Series, University of Melbourne. Retrieved from http://harangue.lecture.unimelb.edu.au/Lectopia/Lectopia.lasso?ut=911&id=70878

Hodkinson, P. (2008). Scientific research, education policy, and educational practice in the United Kingdom: the impact of the audit culture on further education. *Cultural Studies↔Critical Methodologies, 8*(3), 302–324.

Karseth, B. (2006). Curriculum restructuring in higher education after the Bologna process: A new pedagogic regime? *Revista Espanola de Educacion Comparada, 12*(2006), 255–284.

Karseth, B. (2008). Qualifications frameworks for the European Higher Education Area: A new instrumentalism or 'much ado about nothing'? *Learning and Teaching, 1*(2), 77–101.

Karseth, B., & Sivesind, K. (2010). Conceptualizing curriculum knowledge—Within and beyond the national. *European Journal of Education, 45*(1), 107–124.

Lamont, M. (2009). *How professors think*. Cambridge: Harvard University Press.

Marginson, S. (Ed.). (2007). *Prospects of higher education: Globalization, market competition, public goods and the future of the university*. Sense Publishers: Rotterdam.
Maton, K. (2009). Cumulative and segmented learning: Exploring the role of curriculum structures in knowledge-building. *British Journal of Sociology of Education, 30*(1), 43–57.
Minelli, E., Rebora, G., Turri, M., & Huisman, J. (2006). The impact of research and teaching evaluation in universities: Comparing an Italian and a Dutch case. *Quality in Higher Education, 12*(2), 109–124.
Muller, J. (2000). *Reclaiming knowledge: Social theory, curriculum and education policy*. London: Routledge.
Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.
Power, M. (1997). *The audit society: Rituals of verification*. Oxford: Oxford University Press.
Power, M. (2003). Evaluating the audit explosion. *Law and Policy, 25*(3), 185–202.
Reid, A. (2009). Is this a revolution? A critical analysis of the Rudd government's national education agenda. *Curriculum Perspectives, 29*(3), 1–13.
Rizvi, F., & Lingard, B. (2010). *Globalizing education policy*. Milton Park, UK: Routledge.
Shore, C. (2008). Audit culture and illiberal governance: Universities and the politics of accountability. *Anthropological Theory, 8*(3), 278–298.
Tuomi-Gröhn, T., & Engeström, Y. (Eds.). (2003). *Between school and work: New perspectives on transfer and boundary-crossing*. Bingley, UK: Emerald Group Publishing Limited.
Yates, L., & Young, M. (2010). Globalization, knowledge and the curriculum. *European Journal of Education, 45*(1), 5–12.
Young, M. (2008). *Bringing knowledge back in: From social constructivism to social realism in the sociology of education*. London: Routledge.

Part II
Re-thinking and Reform of Education Today—Foundations and Debates

Chapter 2
Knowledge and Education in the 21st Century

This is a time of questioning and reform in relation to the curriculum and the broad mission of schools, universities and other education institutions, and in particular in relation to their role as knowledge transmitters and builders of new knowledge. This chapter reviews for the non-specialist reader some thinking and research that frames 'the knowledge question' for schools and universities today. We begin with a brief section on the changing context that impacts on this issue and then review a number of lines of argument that touch on the role of the disciplines and school subjects that are the focus of this book.

Knowledge itself is an ambiguous term that threads through these debates. Schools and universities are concerned with at least three different ways of taking up knowledge in their programs and purposes. One relates to the object of study that constitutes the curriculum of these institutions. Here decisions are taken, both deliberately and implicitly, about what should be known or learnt about, what matters in the world. This includes decisions about what range of studies are mandated as well as about the relative weight to be given to 'knowing how' and 'knowing that' or variants of these.

A second concern is about the particular characteristics that distinguish knowledge from 'mere' belief or 'innate skill' and the like, the sense in which knowledge is seen as a special kind of learning or cognitive claim with special power. It represents the aspiration of institutions to be making available to students something more powerful or reliable or truthful or valuable than they would otherwise have. Here education institutions have to address the structure or form associated with ways of knowing that are more powerful or incisive or reliable or conceptually astute.

A third sense in which schools and universities deal with knowledge is in how they take account of the social practices associated with knowledge in the sense just mentioned. These may include attention to how disciplines or knowledge fields operate, or to what knowledge in the workplace looks like, or recognition of

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the way in which knowledge is tied to power and capital. These too underpin and are implicitly addressed by the forms and reforms of schools and universities. And each of these lenses on knowledge has been subject to considerable debate in the late 20th and 21st century.

To some extent schools and universities are located differently in relation to knowledge, but both have been facing versions of some similar questions that this chapter reviews.

The Changing Context

A Global World Economy

Although schooling and university systems in countries like Australia have long had a history of looking to other countries (particularly the UK and the USA) for inspiration about their education institutions, from the late 20th century this began to take on a heightened and new form. Concerns about unemployment and national economic wellbeing became self-consciously framed within a picture of global competition, and within a perspective where resources, including human resources, were assessed globally and comparatively. At the same time economists began to emphasise the role of education as a central factor in economic strength (Sharma 2004). And a growing body of influential supra-national measures (via the OECD, World Bank and international university ranking systems) offered some new standardised high-profile lenses on what education systems, both schooling and higher education, were achieving.

The impact of this global comparative economic lens has been widely felt—in the rapid rise and aspirations of systems in China and other Asian and developing countries, and in new anxieties and public debates about standards and quality in the USA, Europe and most parts of the world (see for example Hopmann 2013; Yates and Grumet 2011). This positioning of knowledge as a comparative economic resource underpins on the one hand an ongoing close attention to benchmarking, testing, research metrics and the like; and on the other, an ongoing concern about what kinds of knowledge are economically potent and should be prioritised in schools and universities—for example entrepreneurial capacity, languages, and the ability to work in teams. The focus on education and knowledge as an economic competitive good has been accompanied by expectations for more extended education, where advanced countries now expect to have school completion as the norm rather than achievement of a minority, and where undergraduate education becomes a more mass pursuit than in previous times. Associated with this the role and function of both secondary schooling and undergraduate education has seen considerable reworking: in terms of their length, their function as generic education or as vocational preparation, their relationship to postgraduate education.

Technological Change

Discussions about knowledge and about education in the late 20th and early 21st century are marked by the need to engage with a rapidly changing material world and dramatically changed technological capacities (e.g. Cope and Kalantzis 2009; Sugrue 2008). Compared with a world where knowledge was primarily exchanged in paper form or in face to face meetings, the power, the speed and the forms of new technologies pose challenges to education at all levels especially in relation to what is now foundational. For example the power of computers to work with big data and the distributed form of some of that work globally (especially in physics) poses questions about the directions of influence between theory and calculation that has ramifications for the science curriculum of school, undergraduate curriculum and research training. The changes raise questions about the locality of knowledge and about the various agents of knowledge (human and non-human). In relation to the study of history, the availability of new kinds of searching capacities, new kinds of online archives, ability to search and work with visual texts and oral records and the like is also potentially transformational, in terms of what students might need to learn or be able to do.

One further major impact of the internet and new searching and communication capacities has been to raise questions about the role (or even continued existence) of traditional schools and universities compared with informal learning, new entrepreneurial commercial ventures (for example Griffin et al. 2012; see also Ball 2012; Reckhow 2013) and new entities such as MOOCs (Massive Open Online Courses) and other forms of online learning.

Social Movements, Politics, the Politics of Knowledge

The curricula of schools and universities are never simply a given or a deduction from their national and historical setting—they always represent some deliberate choices, purposes and interests, and traditionally, especially in the case of higher education, reflect some orientation to elite interests and social roles ('leadership' for example). But from the mid 20th century, the politics of what counts as knowledge has been subject to much more vigorous contesting. Social movements concerned with gender and race targeted the content and language of the curriculum as sources of discrimination. They argued, and gained considerable support for, an understanding that what was being conveyed as knowledge was in fact ideological and itself contributing to the continued marginalisation and disadvantage of women and of non-mainstream groups. The attack on the politics of knowledge in schools and universities, and its relation to power, was also evident in broader attacks, for example in the writings of Paulo Freire, Ivan Illich and others in relation to schools; and May 68 student demonstrations in relation to higher education. Later, as world politics shifted from the cold war configuration to new kinds

of conflicts, a range of writings identified and criticised assumptions that were seen as underpinning modern 'western' and 'enlightenment' knowledge, in the process raising issues about secular and non-secular knowledge systems, and the ways knowledge systems in the west had been geared to the interest of the major powers of the 'global north' (Centre for Contemporary Cultural Studies 1982; Connell 2007; Said 1979).

'Internationalisation' and Global Population Flows

In the 21st century a major theme for the university and school curriculum has been globalisation, including the movements of populations for migration and employment, and the opportunities and fears associated with that. In education systems such as Australia's there is much talk about the need to orient to a 21st century world where students will travel, interact and work with people in other parts of the world (see for example Marginson 2011; Peters 2010; Rizvi 2011). Australian universities compete globally for international students as a source of their financial viability, but also for talent to build their research capacity. Internationally there is also increasing awareness of the 'Asian century' and the growing economic significance of China and India. And all of these bring new emphases to the knowledge work of schools and universities. In school curriculum, how curriculum should draw on and work with the diversity of traditions, linguistic backgrounds and knowledge students bring to it is an issue. And the question of what kind of person and citizen schools should be aiming to form—how to achieve social integration with a diverse population—has taken on more visibility. Universities announce their concerns to internationalise, but what this means in terms of student mix, student experience and the curriculum itself is not clear. What does it mean, for example, to 'internationalise' the curriculum in science? Is that a meaningful concept?

This section has barely touched the surface of some major changes that are a context and thread in the debates and developments that we now take up. We go next to a debate that has spurred and encapsulated a good deal of thinking about the 'knowledge creation' end of the work of universities in the context of the 21st century, and follow that with a section taking up some forms in which this changing context has been addressed (divisively) in research, policy and reforms of the school curriculum.

The 'Mode 1' and 'Mode 2' Perspective

In 1994 a group of sociological observers of the changing scene, Gibbons, Limoges, Nowotny, Schartzman, Scott and Trow, published a book entitled *The New Production of Knowledge: the dynamics of science and research in*

Table 2.1 Attributes of mode 1 and mode 2 knowledge production (Hessels and Van Lente 2008, 741)

Mode 1	Mode 2
Academic context	Context of application
Disciplinary	Transdisciplinary
Homogeneity	Heterogeneity
Autonomy	Reflexivity/social accountability
Traditional quality control (peer review)	Novel quality control

contemporary societies (Gibbons et al. 1994). This book coined a widely discussed and influential distinction between 'mode 1' and 'mode 2' knowledge. 'Mode 1' is a term applied to what is deemed the more traditional form of knowledge building and research within universities. It is hierarchical, specialised, and operates to a considerable extent by having a bounded and self-referential form. It seeks refinement and creation by working within and building on the focus and modes of established lines of inquiry (such as the disciplines). 'Mode 2' knowledge is associated with the kind of innovation that has previously been more characteristic in industry and government: knowledge developed in 'contexts of application' (that is, social and economic concerns are built in from the start and are part of the evaluative criteria), and which is built collaboratively, often bringing together those with different kinds of training and interests. The book argued that the latter forms were becoming much more prominent in the late 20th century, and more (though not all) of the work of universities was beginning to take on that form.

Hessels and Van Lente (2008) summarise the main elements said to comprise the divergent forms of knowledge production in Table 2.1.

The arguments in the original 1994 book were further developed and reflected upon both by some of the original authors (e.g. Nowotny et al. 2001) and by many others. In their 2001 elaboration, Nowotny et al. argued that a de-differentiation of social spheres (state, market, culture) is taking place, with observable changes in the modes of operation of universities and government research institutes and research councils. They argue here that mode 2 (contextualised) research yields socially robust knowledge and that this form of knowledge now speaks back to science and is a central referent of government innovation policies (This has certainly been the case in Australia as we discuss further in Chap. 4).

In their 2008 review of a large body of literature relating to the mode 1/mode 2 framework, Hessels and Van Lente identify a range of other theories and lines of argument that have anticipated or which overlap or are allied with the 'New Production of Knowledge' arguments (for example some speak of 'strategic' research, 'triple helix', 'academic capitalism', 'innovation systems' and various others). They conclude that the New Production of Knowledge framework is neither unique nor conceptually tight, and that more empirical research on actual shifts is needed (and this book is one example of such research). But they also acknowledge the widely felt salience of the developments drawn together in that initial account as

a new production of knowledge. Much of the discussion across the literature accepts the growing visibility of practices associated with mode 2 and its closer relationship to contexts of application, social and economic concerns, and collaborative work that crosses university and disciplinary boundaries. What is to some extent at issue is whether this distinction is an entirely new one (in the sense that some fields of science, engineering and the like have always been more applied and collaborative in their relationships and agendas), and, more significantly, whether the mode 2 new production of knowledge is mainly about a shifting of relative balance between the two modes, with both continuing to be present in the work of universities; or whether it is part of a trend in which what remains of disciplinary (mode 1) inquiry will be primarily contained within and circumscribed by the mechanisms and evaluative criteria of mode 2 (see also Weingart and Padberg 2014).

A further issue raised in the literature (and discussed further in Chap. 4) is the extent to which the discussions here of a 'new production of knowledge' function as a normative or advocacy account that is driving new visions of what should be (by politicians and vice-chancellors in particular) as well as the associated political practices and policy instantiations. Here questions about what is being gained and lost in changing contexts of knowledge work are important. These are a point of contention in many recent writings about changing forms of higher education (Blackmore et al. 2010; King et al. 2013; Peters 2007), as well as in arguments about disciplinarity, interdisciplinarity and graduate attributes which we review shortly. And they are one focus of our research project and our interviews with physicists and historians in the second part of this book. How much is their work now being reshaped and made answerable to mode 2 forms of process and evaluative criteria? What opportunities and constraints and rethinking of these fields are now taking place and being enacted in the undergraduate curriculum and the research agendas of individuals and universities?

Disciplinarity and Interdisciplinarity

Prior to and continuing alongside discussions about the 'new production of knowledge' is a body of literature concerned with the social, epistemic and historical dimensions of the academic disciplines, in the form of ethnographic studies (Becher 1989; Charlesworth 1989; Knorr-Cetina 1999) and studies concerned with the organisational, knowledge building and authority structures of universities (Abbott 2001; Kagan 2009). An interest in disciplines, disciplinary differences and their implications for doctoral training and research has been given new attention via the late 20th century and early 21st century upsurge of interest in 'interdisciplinarity' (Bammer 2012; Klein 1996; Trowler et al. 2012). Much of this will be discussed in more detail in Chap. 3 in relation to history and physics, the two disciplines that are the focus of this particular study. Here we briefly outline some knowledge issues and debates relating to disciplines as they may impact on curriculum and research.

'Disciplines' are socially constructed traditions of inquiry that originated in the 19th century and which have been formalised within university structures and through professional associations, journals, conferences and the like, and distinguished by concepts, methodologies and sometimes by their objects of inquiry. They perform cultural and organisational functions as well as epistemological purposes (Abbott 2001). Kagan (2009, 3) notes that most intellectual efforts consist of three components that are differentiated between different disciplines:

> (1) A set of unquestioned premises that create preferences for particular questions and equally particular answers, (2) a favoured collection of analytical tools for gathering evidence, and (3) a preferred set of concepts that are the core of explanations.

But he also argues that disciplines are actually differentiated from each other in terms of nine different dimensions:

1. The primary questions asked, including the degree to which prediction, explanation, or description of a phenomenon is the major product of inquiry
2. The sources of evidence on which inferences are based and the degree of control over the conditions in which the evidence is gathered
3. The vocabulary used […] including […] the degree to which a functional relation was presumed to generalize across settings or was restricted to the context of observation
4. The degree to which social conditions, produced by historical events, influence the questions asked
5. The degree to which ethical values penetrate the questions asked and the conclusions inferred or deduced
6. The degree of dependence on external financial support from government or industry
7. The probability that the scholar works alone, with one or two others, or as a member of a large team
8. The contribution to the national economy
9. The criteria members of each group use when they judge a body of work as elegant or beautiful.

(Kagan 2009, 2–3)

This list represents criteria in terms of which fields or disciplines potentially or often build knowledge differently from each other. If they are managed institutionally in ways that assume uniform performance criteria or organisational norms (for example that 2, 3, 4 and 7 in the list above should look like science—or at least some fields of science—across all fields) this will have consequences for the different fields, and this is one of the directions of governance and management in recent times that is discussed in later chapters of this book.

At the same time, disciplines, while always being stabilised by their plural scientific, educational, administrative and professional functions, are never structurally static but subject to processes of differentiation and dedifferentiation (see Stichweh 1992). One of the themes of the present period is that this is a period in which processes of differentiation, de-differentiation and moves to interdisciplinarity and genericism have speeded up considerably. But not only have the endogenous processes of differentiation and de-differentiation proliferated and speeded up but also the exogenous pressures for change have become increasingly complex and powerful. A further point is that in reality boundaries between disciplines are

often blurred. The US National Research Council Report in 1986 observed that the interface between physics and chemistry 'has been crossed so often that its exact location is obscure' and yet also noted that 'the degree of direct collaborative interaction between physicists and chemists in the USA, especially at universities, [has] remained surprisingly limited' (cited in Klein 1996, 6). All this poses significant challenges for education authorities and for research funding bodies. Decisions must be made about which curriculum foundations and organisational forms are important as enablers of knowledge, and about appropriate roles of disciplines compared with other framing perspectives as the gatekeepers and judges of research quality and new knowledge claims.

One issue for education practice and policy is to understand the structure or form in which knowledge is developed in different fields. Both the literature and management-oriented actions often recognise the need to differentiate the 'STEM' disciplines (science, technology, engineering and mathematics) from the 'HASS' disciplines (humanities and social science) and these in turn from the professional fields (preparation of doctors, teachers, accountants and the like), and this distinction is discussed further in Chap. 3. However, this much-used differentiation between STEM and HASS also glosses over big differences between the disciplines and sub-disciplines that lie within both groupings (consider mathematics compared with zoology, for example; or economics compared with literature).

In terms of our focus in this book, the education issues of knowledge building, Klein (1996) discusses a range of significant differences in how disciplinary fields have operated. These include differences between social sciences fields which have operated with a search for covering laws compared with those building attention to the symbolic and interpretive; and the question of the extent to which disciplines have distinctive disciplinary concepts, methodologies and the like. She argues

> Two kinds of disciplines, the applied and the synoptic, are associated with such high permeability that they are often described as 'inherently interdisciplinary'.
>
> (Klein 1996, 39)

Arguably one of our disciplines in this study, history, would be considered synoptic and 'inherently interdisciplinary', at least in some elements. Nevertheless other voices in the literature on disciplines and interdisciplinarity (such as Abbott 2001; Becher 1989; Kagan 2009) would argue that even disciplines that are synoptic create identities and boundaries that are inherent in how they take in interdisciplinary elements, and in terms of how they build knowledge.

The sociological perspectives and typologies on the forms of knowledge and the shifts within disciplines forms a background to the project we discuss in this book in two ways. First, this is a period of upheaval and change in the governance of universities and the funding structures associated with them. If there are some important differences in the forms of knowledge advanced through different disciplines—in what is needed as foundational study, or in their form of development over the educational cycle, or in the form of publication that best represents their achievements—this is likely to be an issue where universities move to

adopting uniform template-like assessments of productivity or overarching curriculum reforms. We discuss in part four of this book how historians and physicists are affected by (and see their fields being affected by) some of these changes. Secondly, by their nature typologies are crude ways of understanding what is important in a field. We wanted to see how physicists and historians themselves see their fields today—in what sense they understand this as hierarchical or horizontal, the kinds of things they see as fundamental, how they think about and work in a flux of new specialisation, differentiation and de-differentiation.

The sociological literature on disciplines has focused on both the social and epistemological, and in most cases has drawn attention both to what is productively advanced by disciplinary forms of inquiry and social relations, and also recognised the conservative and gate-keeping elements that are associated with these forms (e.g. Abbott 2002; Harding 1987; Spender 1981). A major issue that has been evident in higher education debates in the 21st century, flagged in the earlier section on 'mode 2' knowledge, has been the extent to which disciplines such as history and physics should retain their place as an important building block and specified stream of study. Are traditional discipline-based departments important, or does it make sense to collapse them in new ways—for example as 'materials science' or 'nanotechnology'—or to frame them in terms of social topics or challenges (see Weingart and Padberg 2014). These questions were a focus of interest at a conference on the future of the university held in the USA at the beginning of this century (Brint 2002). Abbott (2002) argued here that, notwithstanding the new challenges and vested interests in the disciplinary departments that formed the heart of US universities, these were likely to persist because, in addition to their vested interests in self-perpetuating, they form ways of managing and focusing inquiry that enables more powerful forms of understanding to develop. He argued that disciplines provide 'problem-portable' knowledge in contrast to a problem-focused curriculum whose learning is of more short-term applied nature and is less deep and less enduring to new problems.

But a decade or so later, much has changed in universities around the world, and even more changes appear to be in train. In this project we set out to see how physicists and historians today see the shape and place of their disciplinary fields. Are they important to preserve in their traditional form as some kind of underpinning to new collaborative activities? Are they changing or being forcibly changed as universities face a new influx of students, and new kinds of demands on what they produce for these students?

The School Curriculum: Which Subjects? Which Skills?

Historically there has been considerable national and philosophical variation in school approaches to knowledge and the purposes of school, including experiments with different forms of progressive or radical or behaviourist pedagogies. However debates about how to make sense of what are important foundations for

young people today have been given new life in recent decades in the wake of developments noted in the first part of this chapter and in the face of an endlessly escalating call on what schools should teach or be responsible for.

In contrast to universities, the overall scope and form of what is mandated is a key issue for schools, and there is much concern about how to respond to such rapid developments in knowledge and technologies, to the 'knowledge explosion', and to the new ways people in the 21st century may work, travel, engage with others. Arguments about the overcrowded curriculum, the possibilities and significance of computers, what knowledge or skills should now be considered foundational, underpin a myriad of reviews and reforms of curriculum around the world.

One approach to cutting through these big shifts in the world and the 'overcrowded curriculum' problem is by finding a different kind of foundation conception for curriculum and its structure rather than trying to amend or elaborate the curriculum of the past and the subjects that it contained. A number of different versions of this have been offered—variously named 'capabilities', 'competencies', 'essential learnings', '21st century skills', 'new basics' and many more. And there are significant differences between these different approaches—for example capabilities is related to Amartya Sen's broad body of work on human rights (Sen 2004; Nussbaum and Sen 2010), while some of the competencies literature is derived from commissioned industry reports about what employers expect of workers. But broadly, these various lines of thinking begin either by trying to identify qualities of the citizen/worker that will be effective in the 21st century and build the curriculum on those, or by trying to seek commonalities or greater integration of skills and capabilities that lie within the subject-based curriculum, and to focus directly on those capabilities or skills as a way of giving coherence and more unity to what schools should do.

In passing, we should note here that the idea of a 'traditional' (subject-based) curriculum can be deceptive. There are national and local variations of what have been the norms in terms of the range of subjects commonly included (Tröhler 2016). Some school subjects are closely tied to university or research disciplines of the same name, others have a looser affiliation with different purposes. In many countries, for example, the subject named after the national language ('English' or 'Swedish') has a broader and different brief than the university discipline of the same name—including elements of civics as well as basic literacy and introduction to literature studies. The school subject of the same name may not include or may resist changes now considered conventional in the cognate discipline of higher education (consider English, history, science). In some places philosophy, psychology, or technology studies may be a longstanding subject for students, and elsewhere not encountered until tertiary study. In this book we are focusing on only two school subjects, history and physics, and discuss here issues of overall curriculum scope (range) and structure only in so far as it impacts on these. But because these two subjects are longstanding inclusions in both the school and university curriculum and in university research, the issue of how teachers and academics understand the purposes and forms of the subjects they teach—and the

kind of development needed at different stages of education—is something we want to revisit here.

Commonly school curriculum reforms are not simply designed by subject or discipline specialists but have a broader professional, community or political input. Such reforms commonly try to accommodate some outward looking assessment to what is important for students beyond school as well as some representation of what is important within subjects. In an earlier review of the changing proposals and thinking about curriculum in Australia we found that two states had developed quite different approaches to grounding a curriculum in 'essential learnings'. In Tasmania there was an attempt to build these bottom up from a community consultation about what knowledge or skills are important today (the story of why and how this initiative collapsed is worth reading, see Anderson and Oelemans 2011; Connor 2011). In Victoria the 'essential learning standards' represented a professional attempt to map underlying skills and process as a matrix across the different subjects and fields of study (Yates and Collins 2010). So similar names here hide very different kinds of approaches to the question of the school curriculum.

In another Australian state, Education Queensland trialled an approach to curriculum known as 'New Basics' (Luke et al. 2000; Lingard et al. 2001; Matters 2006), and it is one example of a more detailed version of an approach to curriculum that does not start with school subjects and the past:

> Multiliteracies and communications media
>
> How do I make sense of and communicate with the world?
>
> - Blending traditional and new communications media
> - Making creative judgments and engaging in performance
> - Communicating using languages and intercultural understandings
> - Mastering literacy and numeracy
>
> Active citizenship
>
> What are my rights and responsibilities in communities, cultures and economies?
>
> - Interacting within local and global communities
> - Operating within shifting cultural identities
> - Understanding local and global economic forces
> - Understanding the historical foundation of social movements and civic institutions
>
> Environments and technologies
>
> How do I describe, analyse and shape the world around me?
>
> - Developing a scientific understanding of the world
> - Working with design and engineering technologies
> - Building and sustaining environments
>
> Thus the New Basics categories capture various aspects of the person in the world:
> - the individual—physically and mentally, at work and at play and as a meaning-maker;
> - the communicator—active and passive, persuading and being persuaded, entertaining and being entertained, expressing ideas and emotions in words, numbers and pictures, creating and performing;

- the group member—in the family, in social groups, government-related groups, and so on;
- part of the physical world—of atoms and cells, electrons and chromosomes, animal, vegetable and mineral, observing, discovering, constructing and inventing.

(Grauff 2001)

The OECD too has sponsored a number of reports concerned with '21st century skills' (OECD 2005; Ananiadou and Claro 2009). Elsewhere an international consortium of academics and major technology companies (CISCO, Intel and Microsoft), led by Patrick Griffin (Griffin et al. 2012) has been developing protocols and materials concerned with how to assess and measure 21st century skills such as 'working in teams', 'problem solving' and the like. Commonly work in this mode references the kinds of changing context that were outlined at the beginning of this chapter and assumes a world where there will be considerable mobility globally, and where the future worker will need to be both flexible and a 'lifelong learner'.

In an earlier study of approaches taken by the different Australian states (Yates et al. 2011), we found that there had been very frequent curriculum reviews and reforms over the late 20th and early 21st century. Some states had maintained a quite traditional subject-based structure of the school curriculum, some had attempted major forms of non-subject-based alternatives, and many had included some elements of both. In practice, many formal curriculum plans today try to include both some subject-based or domain specification, and some skills or capabilities tracking, often expressed as a matrix.

In brief then, one of the big issues for the school curriculum in recent times has been with the issue 'what knowledge matters today?'. This has taken the form of either trying to add subjects (for example computer studies, or different language subjects) or collapse subjects, to change subject content (for example in relation to environment, or towards a more international focus) or to focus on a range of competencies or skills or capabilities as the key issues. But whichever direction has been taken two matters have been frequently noted. One is the problem of an 'over-crowded curriculum'—where the expansion of what is intended to be covered is undermined by the impossibility of doing this in other than superficial ways. The second is the issue of teachers and curriculum practice. Proposals for major changes in curriculum (for example, moving away from a subject structure in secondary school) often take too little notice of teachers' existing professional identities and experience when they introduce major changes with little time and support to teachers (Leggett and White 2011).

Inequality, Politics and 'Bringing Knowledge Back In'

From a system perspective school and university curriculum is constructed to serve a social function in relation to the population, preparing people for their future life, and preparing them collectively for what is seen as the needs of the

nation. In democratic countries the issue of the inequalities and opportunities furthered by curriculum have been major issues of concern, and a central pre-occupation of sociology of education. In recent times though a line of work, 'social realism', has emerged within sociology of education that argues that the knowledge role of schools and universities has been inadequately prioritised both in the broad research literature of sociology of education, and in curriculum reform as mediated by political agendas and various interest groups:

> What is the important knowledge that pupils should be able to acquire at school? If as curriculum theorists, we cannot answer this question, it is unclear who can, and it is more likely that it will be left to the pragmatic and ideological decisions of administrators and politicians.
>
> (Young 2013, 103)

In a body of work beginning broadly in the late 1990s, a number of sociologists have argued that the dominant stream of sociology of education that is concerned with inequalities and reproduction in education has been mistaken, both in its inadequate account of knowledge itself, and in its inability to impact on inequality via education. The 'social realist' stream of work seemed to begin with an article in the *British Journal of Sociology of Education* in 1999 by Moore and Muller (Moore and Muller 1999), and a subsequent elaboration in articles and books (e.g. Moore 2007; Moore and Muller 2002; Morgan 2014; Muller 2000; Young and Muller 2013) but it also acquired particular prominence with the publication of a 2008 book, *Bringing Knowledge Back In* by Michael Young (2008). This book was particularly prominent because Michael Young had been well known as the editor of an earlier 1971 publication, *Knowledge and Control: new directions for the sociology of education* (Young 1971) which had been one of the landmark texts of the focus on the politics of knowledge in the curriculum that was now the subject of his criticism and recantation.

In one sense the claim that knowledge is being neglected might seem strange. What is all the testing and curriculum reform about if not about knowledge? And it might seem quite exaggerated, given that for all the rethinking evident in the debates discussed above, many commentators claim that education has been distinguished more by its recognisable continuity than dramatic difference, and that teachers, in secondary schooling at least, and academics are still largely trained in and committed to particular subjects and disciplines and the knowledge associated with those. But the arguments being made in the 'social realist' body of work concerned with a loss of 'the voice of knowledge' are not simply motherhood ones. They challenge some other lines of thinking about the role of education today.

To begin with they challenge sociologists who see school curriculum only as a message system (conveying messages about who is important or about sexism or racism, for example). The social realist sociologists argue that the consequences of this perspective are that this literature can identify what school may be doing badly (being sexist or racist for example), but can do more than substitute other more positive messages, that this line of argument is limited to affirming existing student identities. The potential of knowledge as compared with messages, they

argue, is not recognized through such an approach. And they are concerned that schooling continues to be expected to take on responsibility for an unlimited range of things and social practices that are considered problematic.

One background to the debates here is the challenges to the politics of knowledge associated with social movements of the second half of the 20th century: second wave feminism, anti-racism and post-colonial movements, disability rights movements and the like. Summarising hugely, these movements not only made claims as to their oppression or marginalisation in society, but identified knowledge and language and curriculum, as a key element in that oppression. Sociology of education became particularly interested in curriculum as a 'message system', one in which both the selection of knowledge and the form of what was considered advanced knowledge compared with low status knowledge contributed to the perpetuation of elites.

Curriculum action associated with these concerns took a number of forms. It included the development of new subjects (Women's Studies, Indigenous Studies), and different selections of what should be taught within subjects (social history and movements from below rather than political history, for example; different texts for English; in science making women scientists more visible). But it included too more far-reaching arguments about the forms of knowledge that were being valued in school. Bourdieu and Passeron (1977), Walkerdine (1988) and Belenky et al. (1986) argued that the concept of rationality valued in school was biased, stacking the odds against working class students, girls and minorities being able to be recognised as an adequate 'rational subject'. Teese (2000), following Bourdieu, suggested that the very kind of disposition required to take on the most abstract forms of physics and the like, the knowledge most valued by schools, were ones that made it most impossible for working class students. Much of this work took a critical stance, aiming to expose the unfairness and ill effects of what the curriculum did rather than directly promote different practices. Where alternatives were advocated they were concerned with showing ways for students in marginalised groups to 'resist' dominant forms, or aiming to teach 'critical pedagogy' of various kinds so students could identify the politics in what counted as knowledge. Many approaches placed major emphasis on the need to focus on students' own understandings of their world and to build from that. At the same time, a similar move to focus school curriculum discussions more on students and their learning and less on curriculum selection and prescription was also building from another not directly political source: an interest in 'constructivist' theories of learning, and the idea of an active learner and process rather than bodies of knowledge as central to the education enterprise (Hattie 2008).

In brief, the argument associated with 'social realism', 'bringing knowledge back in' and 'powerful knowledge' (Muller 2000, 2009; Moore 2013; Young 2008, 2013 in particular) was that sociologists of education had become too concerned with tracking whose knowledge curriculum represents at the expense of what kind of knowledge/intellectual development students were being given access to. They argue that the focus on social constructivism and difference, and on outcomes, relevance and social competencies had led to all students, but especially those from

lower socioeconomic backgrounds, being given access to an impoverished form of education. Underpinning this was a case that the claims that knowledge was irredeemably political and tied to group interests were wrong.

But the social realist arguments were also critical of the extreme positivist view that knowledge is something outside human social activity and unchanging. Rather the kind of knowledge that has been associated with the disciplines is seen as social in origin but organised, focused and refined over time in a way that gives it a particular epistemic strength and power. Different social groups may have more knowledge capital of this kind than others, but it is a contingent association, not an inherent characteristic of this form of powerful or more reliable knowledge itself.

In terms of our two disciplines of focus, history and physics, the 'social realist' argument here is that the disciplines are in origin socially constructed (in that sense not essentialist or realist) and thus fallible, but have been developed, challenged, extended in a disciplined way by a disciplinary community and organised processes over time, and in doing so have built an epistemological power and authority different from 'outward-facing' knowledge that is orientated toward generic processes and concrete problems. To gain access to this more powerful and reliable way of understanding the world, it is necessary to learn the focus and methodologies and way of proceeding of these disciplined forms of knowledge, rather than just pick and choose bits and pieces that might seem relevant to what students are interested in.

In summary then this work is making the following case about knowledge and the school curriculum (Young et al. 2014): (1) knowledge development rather than an array of broad social purposes should be recognised as the central task of what education does; (2) what is meant by knowledge is the kind of powerfully refined forms of understanding contained in disciplines/subjects such as mathematics, science, history, literature, music (contrasting, for example, with learning 'communication skills' or 'workplace competencies' and the like); (3) taking seriously the value of these forms of knowledge has implications for the structure and sequencing of the subjects that represent them; and (4) inequalities and difference among students are real challenges for schools, but this is a pedagogical issue for schools to grapple with, not a grounds for avoiding the central task of giving students access to the forms of knowledge they will not otherwise get.

These arguments have drawn some favourable attention in the UK and Europe (e.g. Beck 2013; Priestly and Sinnema 2014), South Africa (e.g. Shay 2012), Australia (e.g. Wheelahan 2010) and New Zealand (e.g. Rata 2012). Writers responding critically have argued that these arguments about knowledge are in fact conservative ones, too tied to specifically Western traditions, and not addressing changing forms of knowledge within existing disciplines or across these (e.g. Balarin 2008; Green 2010; Yates 2009; Zipin 2013). Critics have continued to argue that inequality and difference among students is in practice going to be reproduced if these arguments are taken up (e.g. Whitty 2010). And they point out too that the arguments being made in the work by Moore, Muller, Young, may have value in some broad reframing of the discussion ('bringing knowledge

back in'), but leave many specific questions not well dealt with (for example, the relationship between school subjects and 'disciplines'; and the question of what matters now given significant within-discipline change). These questions are ones which the project discussed in this book is designed to gain new insights on.

A further issue, again of relevance to both of the subjects we study in this project, is the over-sharp line this 'social realist' line of argument seems to draw between the knowledge role of education, and its social or person formation role. While the social realist arguments make a strong case about the need to learn about disciplines and modes of inquiry, not just treat curriculum as a system of messages, this does not entail that the messages reflected in topic selection and the like are irrelevant—for example whether women are visible in science materials; what story of the nation and the world is conveyed in the history curriculum; and the like. These are potentially relevant to how different groups of students engage in knowledge (whether and who continues with science for example) and to what kinds of civic understandings are formed.

Conclusion

In this chapter we have introduced some of the thinking about knowledge, the disciplines and the role and substance of schools and universities that is forming a context to current practices, with specific regard to those issues and debates that are likely to be pertinent to those working in history and physics in education today. There are strong drives towards a sense of new times that require new organisational approaches if schools and universities are to take up the affordances of new technologies and the like and not be impossibly overloaded. But there are serious concerns too about the value of fields such as history and physics in the education of young people and in research and concerns about how these may fare in the changes taking place. We saw too that researchers who have studied disciplines (and interdisciplinarity) recognise some distinctively different features of how different fields are constituted, and that this is a potential issue for a period that is aiming to steer education knowledge production more deliberately. In schools the issue of student difference, inequality, and what the curriculum should do in relation to that is a key issue, and one that is repeatedly revived. These are all matters we return to as we consider the project findings in later parts of this book.

References

Abbott, A. (2001). *Chaos of disciplines*. Chicago: The University of Chicago Press.

Abbott, A. (2002). The disciplines and the future. In S. Brint (Ed.), *The future of the city of intellect: The changing American university* (pp. 205–230). Stanford: Stanford University Press.

Ananiadou, K., & Claro, M. (2009). *21st century skills and competencies for new millennium learners in OECD countries* (Vol. 41). OECD Education Working Papers. Paris: Organisation for Economic Cooperation and Development (OECD).

Anderson, P., & Oerlemans, K. (2011). Curriculum change: The context for the development of the Tasmanian essential learnings curriculum. In L. Yates, C. Collins, & K. O'Connor (Eds.), *Australia's curriculum dilemmas: State cultures and the big issues* (pp. 66–85). Carlton, VIC: Melbourne University Press.

Balarin, M. (2008). Post-structuralism, realism and the question of knowledge in educational sociology: A Derridian critique of social realism in education. *Policy Futures in Education, 6*(4), 507–527.

Ball, S. J. (2012). *Global education inc.: New policy networks and the neoliberal imaginary.* New York: Routledge.

Bammer, G. (2012). *Strengthening interdisciplinary research: What it is, what it does, how it does it, and how it is supported.* Canberra: Australian Council of Learned Academies (ACOLA) Report. Retrieved from http://www.acola.org.au/PDF/Strengthening%20Interdisciplinary%20Research.pdf

Becher, T. (1989). *Academic tribes and territories: Intellectual enquiry and the cultures of disciplines*. Milton Keynes, UK; Bristol, USA: Society for Research into Higher Education; Open University Press.

Beck, J. (2013). Powerful knowledge, esoteric knowledge, curriculum knowledge. *Cambridge Journal of Education, 43*(2), 177–193.

Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). *Women's ways of knowing: The development of self, voice and mind*. New York: Basic Books.

Blackmore, J., Brennan, M., & Zipin, L. (Eds.). (2010). *Repositioning university governance and academic work*. Rotterdam: Sense Publishers.

Bourdieu, P., & Passeron, J.-P. (1977). *Reproduction in education, society and culture*. London: Sage.

Brint, S. (Ed.). (2002). *The future of the city of intellect: The changing American university*. Stanford: Stanford University Press.

Centre for Contemporary Cultural Studies. (1982). *The empire strikes back: Race and racism in 70 s Britain*. London: Hutchinson.

Charlesworth, M. (1989). *Life among the scientists*. Oxford: Oxford University Press.

Connell, R. (2007). *Southern theory: The global dynamics of knowledge in social science*. Cambridge: Polity Press.

Connor, J. (2011). Why curriculums fall over. In L. Yates, C. Collins, & K. O'Connor (Eds.), *Australia's curriculum dilemmas: State cultures and the big issues* (pp. 261–275). Carlton, VIC: Melbourne University Press.

Cope, B., & Kalantzis, M. (2009). *Ubiquitous learning*. Urbana: University of Illinois Press.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London: Sage.

Grauf, E. (2001). *New basics: Queensland trails a curriculum for tomorrow*. Paper presented at the ACSA 2001 Curriculum Conference: Education Futures and New Citizenships, Canberra, Australian Capital Territory. http://www.acsa.edu.au/pages/images/2001_new_basics_qld_trials_a_curriculum.rtf.doc

Green, B. (2010). Knowledge, the future and education(al) research: A new-millennial challenge. *Australian Educational Researcher, 37*(4), 43–62.

Griffin, P., McGaw, B., & Care, E. (Eds.). (2012). *Assessment and teaching of 21st century skills*. Dordrecht: Springer.

Harding, S. (Ed.). (1987). *Feminism and methodology*. Milton Keynes, UK: Open University Press.

Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to student achievement*. Hoboken: Taylor and Francis.

Hessels, L. K., & Van Lente, H. (2008). Re-thinking new knowledge production: A literature review and a research agenda. *Research Policy, 37*(4), 740–760.

Hopmann, S. T. (2013). The end of schooling as we know it? *Journal of Curriculum Studies, 45*(1), 1–3.

Kagan, J. (2009). *The three cultures: Natural sciences, social sciences and the humanities in the 21st century*. Cambridge: Cambridge University Press.
King, R., Marginson, S., & Naidoo, R. (Eds.). (2013). *The globalization of higher education*. Cheltenham, UK: Edward Elgar.
Klein, J. T. (1996). *Crossing boundaries, knowledge, disciplinarities, interdisciplinarities*. Charlottesville: University of Virginia Press.
Knorr-Cetina, K. (1999). *Epistemic cultures: How the sciences make knowledge*. Cambridge, MA: Harvard University Press.
Leggett, B., & White, R. (2011). Waves of change: The critical role of assessment, reporting and accreditation in senior secondary curriculum reform in WA, 1975-2005. In L. Yates, C. Collins, & K. O'Connor (Eds.), *Australia's curriculum dilemmas: State cultures and the big issues* (pp. 240–257). Carlton, VIC: Melbourne University Press.
Lingard, R., Ladwig, J. G., Luke, A., Mills, M., Hayes, D., & Gore, J. M. (2001). *Queensland school reform longitudinal study: Final report*. Brisbane: Education Queensland.
Luke, A., Matters, G., Barrett, R., & Land, R. (2000). *New basics project technical paper*. Brisbane: Education Queensland.
Matters, G. (2006). Good data, bad news, good policy making. *QTU Professional Magazine, 21*, 18–24.
Marginson, S. (2011). Global position and position-taking in higher education: The case of Australia. In S. Marginson, S. Kaur, & E. Sawir (Eds.), *Higher education in the Asia-Pacific* (pp. 375–392). Dordrecht, The Netherlands: Springer.
Moore, R. (2007). *Sociology of knowledge and education*. London: Continuum International Publishing Group.
Moore, R. (2013). Social realism and the problem of the problem of knowledge in the sociology of education. *British Journal of Sociology of Education, 34*(3), 333–353.
Moore, R., & Muller, J. (1999). The discourse of voice and the problem of knowledge and identity in the sociology of education. *British Journal of Sociology of Education, 20*(2), 189–206.
Moore, R., & Muller, J. (2002). The growth of knowledge and the discursive gap. *British Journal of Sociology of Education, 23*(4), 627–637.
Morgan, J. (2014). Michael Young and the politics of the school curriculum. *British Journal of Education Studies,* 1–18.
Muller, J. (2000). *Reclaiming knowledge: Social theory, curriculum and education policy*. London; New York: RoutledgeFarmer.
Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.
Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. Cambridge: Polity Press.
Nussbaum, M., & Sen, A. (2010). *The quality of life*. New York: Routledge.
OECD. (2005). *Definition and selection of competencies executive summary.* Paris: Organisation for Economic Cooperation and Development (OECD). Retrieved from http://www.oecd.org/pisa/35070367.pdf
Peters, M. A. (2007). *Knowledge economy, development and the future of higher education*. Rotterdam, The Netherlands: Sense Publishers.
Peters, M. A. (2010). Cultural exchange, study abroad and discourse of the other. In S. Marginson, P. Murphy, & M. A. Peters (Eds.), *Global creation: Space, mobility and synchrony in the age of the knowledge economy*. New York: Peter Lang.
Priestley, M., & Sinnema, C. (2014). Downgraded curriculum? An analysis of knowledge in new curricula in Scotland and New Zealand. *Curriculum Journal*, *25*(1), 50–75.
Rata, E. (2012). The politics of knowledge in education. *British Educational Research Journal, 38*(1), 103–124.
Reckhow, S. (2013). *Follow the money: How foundation dollars change public school politics*. New York: Oxford University Press.

Rizvi, F. (2011). Theorizing student mobility in an era of globalization. *Teachers and Teaching, 17*(6), 693–701.
Said, E. W. (1979). *Orientalism*. New York: Vintage.
Sen, A. (2004). Development as capability expansion. In A. K. Shiva Kumar & S. Fukuda-Parr (Eds.), *Readings in human development: Concepts, measures and policies for a development paradigm.* New Delhi; New York: Oxford University Press.
Sharma, B. R. (2004). *Strategies of non-formal education*. New Delhi: Sarup & Sons.
Shay, S. (2012). Conceptualizing curriculum differentiation in higher education: A sociology of knowledge point of view. *British Journal of Sociology of Education, 34*(4), 563–582.
Spender, D. (1981). *Men's studies modified*. Oxford: Pergamon.
Stichweh, R. (1992). The sociology of scientific disciplines: On the genesis and stability of the disciplinary structure of modern science. *Science in Context, 5*(1), 3–15.
Sugrue, C. (Ed.). (2008). *The future of educational change: International perspectives*. London; New York: Routledge.
Teese, R. (2000). *Academic success and social power: Examinations and inequality*. Carlton, VIC: Melbourne University Press.
Tröhler, D. (2016). Curriculum history or the educational construction of Europe in the long nineteenth century. *European Educational Research Journal*, *15*(3), 279–297.
Trowler, P., Saunders, M., & Bamber, V. (Eds.). (2012). *Reconceptualising tribes and territories in higher education: Practices in the 21st century*. London: Routledge.
Walkerdine, V. (1988). *The mastery of reason: Cognitive development and the production of rationality*. London: Routledge.
Weingart, P., & Padberg, B. (2014). *University experiments in interdisciplinarity: Obstacles and opportunities*. Bielefeld: Transcript.
Wheelahan, L. (2010). *Why knowledge matters in curriculum: A social realist argument.* Abingdon, Oxon; New York: Routledge.
Whitty, G. (2010). Revisiting school knowledge: Some sociological perspectives on new school curricula. *European Journal of Education*, *45*(1), 28–45.
Yates, L. (2009). From curriculum to pedagogy and back again: Knowledge, the person and the changing world. *Pedagogy, Culture & Society, 17*(1), 17–28.
Yates, L., & Collins, C. (2010). The absence of knowledge in Australian curriculum reforms. *European Journal of Education, 45*(1), 89–102.
Yates, L., Collins, C., & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: State cultures and the big issues.* Carlton, VIC: Melbourne University Press.
Yates, L., & Grumet, M. (Eds.). (2011). *Curriculum in today's world: Configuring knowledge, identities, work and politics*. New York: Routledge.
Young, M. (Ed.). (1971). *Knowledge and control: New directions for the sociology of education*. London: MacMillan.
Young, M. (2008). *Bringing knowledge back in: From social constructivism to social realism in the sociology of education.* London: Collier MacMillan.
Young, M. (2013). Overcoming the crisis in curriculum theory: A knowledge-based approach. *Journal of Curriculum Studies, 45*(2), 101–118.
Young, M., & Muller, J. (2013). On the powers of powerful knowledge. *Review of Education, 1*(3), 229–250.
Young, M., Lambert, D., Roberts, C., & Roberts, M. (2014). *Knowledge and the future school: Curriculum and social justice*. London: Bloomsbury Publishing.
Zipin, L. (2013). Starting from pedagogical zero in 'developing' contexts? Let's re-imagine!: A response to Hugo and Wedekind. *South African Review of Education, 19*(1), 158–166.

Chapter 3
History and Physics as Disciplines

History and physics constitute interesting cases to investigate in relation to the claims about disciplinarity and new forms of knowledge discussed in the previous chapter. These two disciplines have been long represented in the curriculum of schools and universities, are often considered 'enabling' or 'core' fields in terms of the sciences and humanities, and are often taken as emblematic examples in sociological accounts of differences in form between the sciences and the humanities or social sciences. History and physics were also selected for this research project because they have historically been seen as prestigious and important in Australia's knowledge-building enterprise and national standing yet in the funding and teaching reforms of Australian universities over the past couple of decades have at times struggled to maintain financial viability, numbers and integrity as departments. Within Australia in the past decade, history was given a new prominence by being chosen to be one of the first four mandatory subjects to be developed for the new national school curriculum; and the public perception of physics has been boosted by a charismatic Australian Nobel prize winner, and other funding initiatives at the research level.

This chapter discusses previous research on these two disciplines, particularly focusing on arguments about these fields as a form of knowledge, particularly their different structural forms. The chapter reviews briefly how the two disciplines have been categorised and discussed in literatures concerning disciplinarity and disciplinary forms, including the distinctions drawn between the Humanities and Social Sciences (HASS) compared with the Science, Technology, Engineering and Mathematics (STEM) disciplines. We also discuss issues that have been raised about the standing and teaching of these fields within the Australian context, including the problems they identify in their own professional associations and reviews.

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Disciplinarity and Differences between the Humanities and the Sciences

Disciplines describe particular frameworks that have been important in the acquisition and dissemination of academic knowledge. They are socially constructed traditions of inquiry which have been formalised within university organisational structures (Abbott 2001). The concept of what constitutes a discipline is far from straightforward but a number of common features have been identified within the literature on disciplinary cultures (e.g. Becher 1989b; Becher and Trowler 2001; Neumann 2009). These include marking out a particular knowledge focus, having accepted methodologies in relation to the production and communication of that knowledge, having recognised progression paths for the development of researchers and teachers, and the establishment and reproduction of disciplinary boundaries (Neumann 2009).

Differences between disciplines have also been the subject of a range of different maps and models. Most of these draw a particular distinction between the physical sciences on the one hand and the humanities and social sciences on the other (for example see Abbott 2001; Bernstein 1996; Biglan 1973a, b; Becher 1989b; Dressel and Mayhew 1974; Hirst 1975; Phenix 1964; Scheffler 1965; Schwab 1962, 1978; Swoboda 1979). Since C. P. Snow's much-cited 'Two Cultures' lecture of 1959, which proposed that the academic world was split into two opposing and mutually incomprehensible cultures, one aligned with the humanities and the other with the sciences, there has been a longstanding debate about the differences between these two cultures and the merits and limitations associated with each. The debates have been complicated further by the more recent tendency to characterise the two camps as 'STEM' (Science, Technology, Engineering and Mathematics) and 'HASS' (Humanities, Arts and Social Sciences), since both of these acronyms bring together fields that have some significant distinctions of purpose and knowledge form: science compared with engineering, for example, and humanities compared with social sciences, in addition to the different disciplinary specificities within science or humanities. Arguably the binary STEM/HASS distinction is particularly related to policy level interventions in research funding and education purposes and the kinds of convenience categorisations that often accompany this.

In terms of some finer differentiations that are relevant to our two chosen fields, Kagan (2009), for instance, says that the social sciences can be divided between those which study qualities with biological origins or correlates and those which investigate characteristics that are established and changed by social conditions. He further draws attention to differences between the model seeking and applied social purposes of many of the social sciences, compared with the messy, creative and critical agendas of the humanities. But even these rough distinctions are not consistently held in either the literature or in organisational and funding arrangements. For example, Kagan does not include history in his list of disciplines that make up social sciences, but places it in the humanities, yet in Australia, historians are strongly represented in the Australian Academy of Social Sciences as well as in the Australian Academy of the Humanities.

In this chapter we do not have room to discuss the various arguments about reasons for the rise and fall of the humanities—often focusing on matters such as the move to big funding, fascination with 'scientific methods' as the basis of all progress, a policy emphasis on ultility and impact, the effects of social movements and the rise of postmodernism (see Kagan 2009 for an extended discussion). Rather we try to outline here some of the main characterisations of the forms of knowledge as they potentially differ between our two specific fields as a prelude to discussion of the empirical findings in the later sections of this book. The account that follows is necessarily a highly summarised account of the literature, and we focus particularly on sociological observations of characteristics and structure of different knowledge fields that are particularly relevant to the current changing conditions, rather than the underpinning rationales related to different objects of study that have produced differences between humanistic studies and physical sciences. For example there is a major and longstanding discussion not taken up here about the methodological implications of differences between studies of the physical world and the world of meaning-making and situated human beings (for example Winch 1958). Readers of this chapter who come from physics or history, rather than the sociology of these fields, may take issue with some of the ways their fields are depicted (for example the emphasis on physics and sciences as working with paradigm consensus, or the tendency of some of the models to downplay the extent of explanation testing in the social sciences). Typologies tend to break down to some extent once we scrutinise fields more closely, but they are nevertheless intended to identify some of the broad shape of the structure or form of work that is observed in them, and how it differs in particular between sciences and humanities.

Within higher education, understandings of disciplines and disciplinary cultures have been particularly informed by the work of Tony Becher. Drawing on Biglan's earlier work (Biglan 1973a, b), Becher's well known typology differentiates disciplines as hard or soft in terms of their degree of paradigmatic and theoretical consensus, and as pure or applied in their degree of concern with knowledge application, identifying four broad types: hard-pure, soft-pure, hard-applied and soft-applied (see Becher 1989b; Becher and Trowler 2001). The typology operates at a broad level of analysis, and disciplines are understood as not static but with boundaries that are both contestable and flexible. Under the hard/soft dimension, the physical and natural sciences are identified as hard, well-structured, or paradigmatic disciplines (that is, they work cumulatively on a problem within an agreed paradigm of investigation). The nature of this form of knowledge is classified as cumulative, with clear criteria for knowledge verification and obsolescence and consensus over the central questions to address. By contrast, the humanities and social sciences are designated soft in that they do not typically draw on a single commonly agreed body of theory that proceeds by testing and refining of that but incorporate paradigm divergence and methods. The knowledge here is defined as reiterative and holistic, with ongoing dispute over the criteria for knowledge verification and the questions requiring attention, resulting in a focus on understanding and interpretation rather than discovery and causal explanation.

Muller (2009) has argued that this typology can also be used to explain how different disciplines operate, within the specific context of universities, as social entities: that is, that the social practices and identity formation bears some relation to the form of knowledge in each field:

> The 'hards' are higher in social connectedness, so they collaborate more in teaching, especially at the lower levels where less is contentious. Consequently, they spend far less time than the 'softs' in lesson preparation. Since their teaching, research and supervision is better integrated, and since they spend less time on supervision – less than a quarter of the time spent by 'softs' […] – they have far more time for research, which they see as their fundamental mission as academics. The 'softs' by contrast spend far more time both on lesson preparation and on actual teaching; they spend far more time on undergraduate teaching than on supervising postgraduates, unlike the 'hards'; and supervision is a far greater chore for the 'softs' than it is for the 'hards', because they all too often supervise outside their own specific research focus area […]. Invariably then, they end up researching and publishing less.
>
> (Muller 2009, 8)

And research and publishing too take different forms in differently structured knowledge fields.

Like Becher, Bernstein (1996) also explored differences between the STEM and HASS fields, through his categorisation of horizontal and hierarchical knowledge structures. For Bernstein (1996), humanities and social sciences disciplines such as history are categorised as horizontal knowledge structures as they have 'a series of specialised languages, each with its own specialised modes of interrogation and specialised criteria […] with non-comparable principles of description based on different, often opposed, assumptions' (Bernstein 1996, 172–173). Within horizontal knowledge structures, knowledge is progressed horizontally through the addition rather than incorporation of new approaches. In contrast, hierarchical knowledge structures like physics and other natural sciences are based on 'an explicit, coherent, systematically principled and hierarchical organisation of knowledge' (Bernstein 1996, 172–173).

Maton (2009) uses Bernstein's ideas and adds a further distinction between what he calls 'knowledge' and 'knower' codes. Maton argues that in a 'knowledge code' (such as physics), teaching and assessment focuses on epistemic relations and social relations are downplayed. In a 'knower code' (such as history) teaching attends to developing the appropriate dispositions of knowers for that field, and specialist knowledge and skills are downplayed. In relation to school curriculum, his work explores how these different emphases are reflected in the assessment practices of different subjects.

Bernstein was also concerned with distinguishing between traditional and newer and professional fields. Instead of the term discipline, Bernstein (1996, 52) defined history and physics (and other established fields such as chemistry, economics, psychology etc.) as 'singulars' which he characterised as 'narcissistic, oriented to their own development, protected by strong boundaries and hierarchies'. For Bernstein, 'singulars are knowledge structures whose creators have appropriated a space to give themselves a unique name, a specialised discrete

discourse with its own intellectual field of texts, practices, rules of entry, examinations, licences to practice, distribution of rewards and punishments' (1996, 52). Singulars generate strong inner commitments towards knowing, centred in the perceived intrinsic value of the particular field. According to Bernstein, within singulars, the subject 'becomes the linchpin of identity. Any attempt to weaken [the boundaries] between subjects or change classification strength […] may be felt as a threat to one's identity' (Bernstein 1996, 55).

Work in the social realist tradition (of the kind discussed in Section 'Knowledge and the Social World: Inequality, Politics and 'Bringing Knowledge Back In'' of Chap. 2) follows Bernstein's understanding of disciplines as singulars, and sees specialised disciplinary knowledge as importantly distinct from outward-facing, experience-based or problem-oriented knowledge. Under this argument, disciplines are important both because the things they deal with matter and because they have developed distinctive, systematic and refined modes of inquiry or intellectual work. Social realists argue that disciplines are in origin socially constructed (in that sense not essentialist or realist) and fallible but they have been developed, challenged, extended in a disciplined way by a community over time in a way that gives them a unique form of power and authority or reliability. Drawing on earlier work by Bernstein and Durkheim, they suggest that disciplinary knowledge is powerful because it is different from everyday experience, and oriented to more conceptual and generic forms of knowing. In such work, history and physics are frequently referred to as exemplar disciplines, in ways that draw attention to their commonalities, as well as their differences.

As can be seen from this discussion and as pointed out by Becher and Trowler (2001, 41) the concept of a discipline is 'not altogether straightforward'. Disciplines rarely fit neatly into categories, and generalisations about 'the sciences' and 'the humanities' often are an imperfect match with at least some of their component disciplines. Many disciplines have much internal variation and overlap with other disciplines and their boundaries are neither obvious nor static. Over time disciplines change for a variety of reasons including new trends, external pressures, requirements for new methodologies or in the pursuit of new knowledge. This can lead to some disciplines merging, the formation of new fields of enquiry and other disciplines fading away. However disciplines are very much part of the vernacular of education and 'people with any interest and involvement in academic affairs seem to have little difficulty in understanding what a discipline is, or in undertaking a confident part in discussions about borderline or dubious cases' (Becher and Trowler 2001, 41).

History as a Discipline

There is a large and varied body of literature in which the nature of history as a discipline has been debated from within the academic community, from Carr's *What Is History?* (1962) and Elton's *The Practice of History* (1968) to a range

of more recent contributions, whose titles give some of the flavour of the discussions: *What is History Today?* (Gardiner 1988), *What is History Now?* (Cannadine 2002), *Deconstructing History* (Munslow 2006), *A History of History* (Munslow 2012), *Manifestoes for History* (Jenkins et al. 2007), *At the Limits of History* (Jenkins 2013), and 'Horizons of history: space, time and the future of the past' (Armitage 2015). Carr's and Elton's texts in particular are positioned as seminal texts capturing two alternative viewpoints on the practice of history and its claims to objectivity and truth. In the former, Carr argued against the then pervasive belief that historical facts could exist objectively and independently of historical interpretation, while Elton saw this as a form of relativism and emphasised the craftsmanship and considered principles of historical method. In the late 20th century, debates on historical craft, interpretation, evidence and theory have continued, as history, along with other areas of the humanities and social sciences, engaged with feminist and post-colonial challenges, and the critical questioning associated with postmodernism and post-structuralism. More recently the debate has continued, taking up topics of scale and focus (long form and macro and micro focus; national compared with transnational perspectives).

History was an object of study in Biglan's (1973a, b) formulation of a disciplinary typology and later was one of the twelve original disciplines studied by Becher (1989b) as part of his reworking of that typology. Under Becher's typology, history is defined as a soft-pure discipline, meaning it does not have a high degree of paradigmatic or theoretical consensus and is not concerned with practical application. For Becher and Trowler (2001, 36), this means the nature of the disciplinary knowledge is characterised as 'reiterative; holistic (organic/river-like), concerned with particulars, qualities, complication; personal, value-laden; dispute over criteria for knowledge verification and obsolescence; lack of consensus over significant questions to address; results in understanding/interpretation'. They cite Weber's (1977) comment that 'essentially … the study of history is the re-reading of the past … in the beginning because one wants to discover it for oneself and assimilate it, and later because what one looks for (hence sees) in familiar territory may be quite different from what one has discerned before or learned from others' (cited in Becher and Trowler 2001, 40).

Becher's study of history drew on interviews with 20 historians at University College London and University of California, Berkeley, following two pilot interviews at the University of Sussex. In a paper analysing the history study as a discrete case, Becher (1989a, 264) proposed that:

> …history is the study of people in time: its subject matter could embrace anything that impinges on human society. Yet despite this catholicity of coverage there is an underlying sense of unity – historians 'have something in common'; 'share common assumptions and styles of thought'; 'inhabit a particular and definable world'. The disciplinary boundaries, both internal and external, are easily breached and readily redrawn […] Even if fragmentation is inevitable in practice, it is held as desirable in principle for all historians to develop interests outside their own particular field of expertise and to sustain a high level of mutual intelligibility. History comprises interlocking areas of interest, a continuum rather than a set of discrete sub-disciplines. Nor are the distinctions between history and neighbouring disciplines seen as tidy and clear-cut. It is 'almost impossible to draw the

> boundaries round history: they are 'potentially endless'. They have been greatly extended in recent years, as history has moved outwards to incorporate various aspects of the social sciences.'
>
> (Becher 1989a, 264).

Becher suggests that history is 'characterised by internal unity and external openness' (1989a, 264). For the historians interviewed by Becher (1989a) interpretation is not open but is grounded in ideas of plausibility, certitude and proof. He suggests that in comparison to sociology, history does not claim to provide generalisable findings but focuses on specificity and particularities. Historians, according to Becher and Trowler (2001, 109) 'tend to gossip about their sources, about their merits and whereabouts—they talk more about the tools of the trade than the trade itself'. This is because, 'the nature of the subject lies in details, so that a problem cannot often be adequately defined in conversation' (2001, 109).

History, like physics, can be categorised as a convergent discipline, according to Becher and Trowler (2001, 187). They argue that this convergence encourages the eliteness of the fields as it allows for the collective promotion of interests. They comment that

> Its diversity of coverage is much greater than that of physics, in that its subject matter knows few restrictions. It is not characterised by an dominating conceptual structure, nor by any strongly developed techniques or methods of enquiry (indeed historians, tend to describe their discipline as a craft, to assert that it is 'rooted in evidence, not based on theories', and to comment that 'history has sources but no methods'). Nonetheless, there is, as among physicists, a sense of inhabiting 'a particular and definable world', a sharing of 'common assumptions and styles of thought', and a strong tradition of intellectual kinship. 'Most historians', said one, 'see themselves as part of the same fraternity'; more historians used the phrase 'community of scholars' than did respondents in any other discipline.
>
> (Becher and Trowler 2001, 187)

In a 2011 submission related to the development of national teaching and learning standards in higher education in Australia, the Australian Historical Association (AHA) echoes this sentiment:

> The AHA is deeply concerned by the relegation of discipline communities in this section of the document to "other involved parties". […] the document as a whole is surprisingly neglectful of the proper place of the discipline communities in standards formulation and verification process.
>
> (Lake 2011, 2)

Becher writing three decades ago (1989a) suggested that history is less competitive than physics because there is not the same pressure to publish results and new issues are less clearly defined. He noted that research was primarily published in book form rather than journal articles, and the availability of grant funds has only a marginal effect. In a later work, Becher and Trowler (2001) noted that history had been challenged by new funding arrangements and shifts towards a stronger market orientation in universities. And some of the features about the form of historical research and publication Becher had noted earlier are under challenge in contemporary forms of research performance review that we will discuss in later chapters.

We have not here tried to show with any subtlety the ways in which historians themselves characterise their field, but only to indicate some of the characteristics of the field that those who study it from a sociological perspective have noted. Many of these observations date from the late 20th century and many of the characteristics noted there have some significance as we interview historians now in the context of the changing university environment. Later chapters will touch on some of these issues: for example the implications of 'internal unity but external openness' or of an interest in specificity rather than generalisability in the context of top down approaches to undergraduate reform; and the changing significance of grants for non-scientists as well as scientists, and of publication in the form of journal articles.

History in Australian Schools and Universities

In relation to schooling, history and history curriculum development have become increasingly politicised in recent years and there has been considerable public debate about school history and what it should do, both in relation to its content and its relevance to the role of schools today. This debate has primarily been about the kind of history that should be taught and the message young Australians should be given via schooling about Australia's identity as a nation. The debate itself has been embedded within wider ideological disputes about the purposes and place of Australian history and identity, which have been prevalent since the 1960s and 1970s but which became particularly visible in the 1990s (Clark 2006; Macintyre and Clark 2003). These disputes, commonly referred to as the 'history wars', have focused primarily on the place of accounts of Indigenous dispossession, colonial violence and the removal of children in the story of Australian history, with historians seeking to provide greater acknowledgement of the ills perpetrated towards Indigenous Australians on the one side (for example, Manning Clark, Henry Reynolds), and others suggesting this work has led to an overshadowing of the positive aspects of Australian history in terms of its democratic traditions and struggles in the two world wars on the other (for example, Geoffrey Blainey, Keith Windshuttle). This debate has been about national identity as well as about historical craft and the reliability of written records and oral forms of testimony in the telling of the Australian story. Such contestations about national history and identity are not unique to Australia but have been prevalent around the world, notably in Germany and Japan and their divergent struggles to remember and come to terms with the Second World War (Taylor and Guyver 2012).

As part of the renewed attention to history in the school curriculum in Australia, the last few decades have seen strong moves to make the study of history more nationally uniform than previously. Curricula in Australia have traditionally been developed within the states and in the past the state based curricula have differed on whether history should be taught as a separate subject in junior and middle secondary school or in an integrated combination ('Social Education',

combining history and geography, was favoured in Victoria and South Australia) (see Clark 2006, Taylor and Clark 2006; Yates et al. 2011). Integrated forms of history study have been identified as a source of concern by academic historians, who worry about the diminished amount of history students are exposed to in high school and how well history as such is recognised (Millar and Peel 2004). Where history has been taught as a distinct subject, different states and schools have made different decisions as to what should be offered (for example, Ancient History was popular in NSW and Queensland; and 'Revolutions' was the popular year 12 history choice in Victoria), and have emphasised different approaches to history teaching (Queensland, for example, has an enormous emphasis on a research project and large amounts of writing on every aspect of the methodology and design and justification of this). The approach to the teaching of Australian history too has been varied around the country and across different classrooms and these differences were part of the justification for a more national approach.

Following a national inquiry into school history titled *The Future of the Past* (Taylor 2000), which found that the teaching of Australian history in schools was characterised by topic repetition and a lack of continuity and coherence, Prime Minister John Howard convened a national History Summit to develop a draft for a national Australian history curriculum in 2006. When the Labor party won government in 2007, a National Curriculum Board (later the Australian Curriculum, Assessment and Reporting Authority or ACARA) was established to develop a national curriculum framework, beginning with four key subjects of which history was one. Australia does not have a strong tradition of 'civics' in its school curriculum (compared with the USA for example), but developing foundations for citizenship was one of the priorities of the new national curriculum. A national history curriculum was subsequently developed and approved in 2010, and a slow and uneven process of implementation began across the different states. Later again, questions of balance and emphasis in the history curriculum framework were specifically raised in terms of reference for the review of the Australian Curriculum commissioned by the Liberal National Party government led by Tony Abbott in 2013. Following this review, history was subsumed under a broader humanities and social sciences subject in the primary years, and the content was revised to strengthen references to 'Western' influences in Australia's history.

The original content framework for the Australian Curriculum broadly took a 'World History' approach. Elements of Australian history were present across the year levels, but within a framework over the school years that spanned ancient to contemporary times, and that was notably less Anglo-centred than many previous versions. There was some scope for schools locally choosing and shaping topics, but an intention that the broad content focus (period/theme) of each stage would be common. Senior Secondary curricula for subjects in Ancient and Modern History were also endorsed in December 2012, but the arrangements for how those are incorporated into state-based certification frameworks have been left to the states to determine.

A second concern has been in relation to diminishing enrolments, although this has typically referred to concerns with student lack of engagement in Australian history, rather than the study of history as a whole. In the state of Victoria, a recent

report (VCAA 2013) illustrates that enrolments in Australian history in Year 12 remain in decline, but overall history enrolments have increased as a result of the popularity of the 'Revolutions' subject in which students study two of the world-changing revolutions (such as the French, Russian, Chinese or American revolutions). In the media, this was reported as 'Passion for Australia's past becomes history' and 'Australian history will need a revolution to turn around the decline in students choosing the subject in VCE' (Preiss and Butt 2013). History in schools, particularly Australian history, is seen by many to be repetitive and uninteresting for students, both within schools and by the wider public. In earlier reviews of the Victorian Year 12 Australian History curriculum, teachers and curriculum drafters were concerned with the amount of content students were required to cover, and whether this is implicated in the declining numbers of students (Clark 2006).

At the university level, history has historically been seen as an important and prestigious discipline, and enjoyed a high public profile and prominence. The study of history at Australian universities and as a core component of the Bachelor of Arts is longstanding. Modern History and Literature was one of the first four professorial appointments to the University of Melbourne after its establishment in 1853 (the others were in Classics, Pure and Applied Mathematics and Natural Science), and a Department of History and Economics was one of six departments established at the newer University of Western Australia when it began teaching students in 1913 (Pascoe 2003).

Outside the university walls, history has also played an important role in public discourse, and historians have frequently been prominent in Australia in broader social movements related to labour, feminism and race. Today, the Prime Ministers Literary awards include a 'Non-fiction and History' category and several state-based history awards have been established. It is worth noting that these awards recognise books, usually ones written to speak to a public as well as to an academic reader. Elsewhere concerns have been raised about how books are treated in universities today compared with peer-reviewed journal articles in new forms of research assessment in Australia, and this will be discussed further in later chapters. This public recognition of the importance of history is not unique to Australia but is also seen in the USA and elsewhere, where commemorative dates are frequently dedicated towards history including Black History Month, LGBT History Month, Confederate History Month and Women's History Month in the USA.

In Australia, historians are also well represented in prestigious national academic bodies. They continue to disproportionately populate the two Academies of the Humanities and the Social Sciences. The Australian Historical Association (AHA) is the peak national body of academic historians in Australia and includes several hundred academic members located in more than 30 universities across the country (Lake 2011). In her presidential address to the AHA in 2002, Roe (2002–2003) reported that there are 84 history-related associations listed in the Directory of Australian Associations, although she also noted concerns that the field lacked national coherence and suggested that without a national AHA journal the space available for professional commentary and debate was diminishing. A journal, *History Australia*, was subsequently established.

History has also fared relatively well in university enrolment and funding terms compared with other HASS disciplines. In the 1990s the numbers of students taking history increased from 6982 in 1990 to 7674 in 2000, although the proportion of students taking history within the BA declined in percentage terms (from 10 % in 1990 to just over 8 % in 2000) (Pascoe 2003, 44–45). In 2012, history was the most widely offered major in the BA (followed by sociology and then psychology, which had previously held first place in 2008) (Turner and Brass 2014).

In relation to research funding, history receives very limited public expenditure compared with the STEM disciplines, but is relatively well funded compared to other HASS fields. The History and Archaeology category received the largest share of HERDC research income from across the humanities and creative arts disciplines in the period 2006–10, and saw a particularly notable rise in category 2 research income in 2010 (Turner and Brass 2014, 47). The History and Archaeology category also fared well in relation to the Australian Research Council's competitive research grants, and received 12 % of the total funding provided to the HASS disciplines across 2002–2012 (behind Studies in Human Society (21 %) and Psychology (16 %)), including a high proportion of the 'Future Fellowships' provided to mid-career academics (Turner and Brass 2014, 52, 57). The History and Archaeology category was one of the highest achievers in the 2010 and 2012 national research performance assessment exercise, Excellence in Research for Australia (ERA) (along with Medical and Health Sciences, Law and Legal Studies, Chemical Sciences, and Language, Communication and Culture), with 89.7 % of its 27 units of evaluation rated at or above 'world standard' (Turner and Brass 2014, 61–63). Historical Studies was also listed as one of 62 disciplines growing at a rate greater than average in the ERA 2012 National Report.

However, despite the prestige and prominence of history, in past decades many history departments in universities have been significantly impacted by changing funding patterns. Over the last 15 years, although most universities continue to offer history in some form and the numbers of academic historians have stopped declining to the extent they did throughout the 1990s, the numbers of departments dedicated solely to history have declined as multidisciplinary schools have become more prevalent (see O'Connor and Yates 2014). Staff-student ratios have worsened as the numbers of students attending university have increased, and the range and depth of subject offerings have been reduced. History is also reliant on the contributions of unsalaried staff, and in the 2012 ERA assessment research productivity was heightened by the high numbers of staff publishing within the field but employed in non-academic roles. Equally history departments often have a number of honorary staff or retired academics that continue to publish. In the History and Archaeology category, five per cent of staff within this category were identified as producing 23 % of published outputs (Turner and Brass 2014, 80).

Since the mid-1990s, there have been numerous reviews of the status of the history discipline and its teaching at Australian universities commissioned by the Australian Historical Association (see Hughes-Warrington et al. (2009) for a list of reports published in the 1990s). Roe (2002–2003) has noted that the Australian Historical Association was particularly concerned about a crisis in history in

the late 1990s, following reports that the numbers of historians employed in Australian universities declined by approximately a quarter throughout that decade (see Crotty and Eklund 2006, 47.2). However in later surveys in 2002, the AHA found that 'history in the universities is probably holding its own identity-wise, despite the re-structurings which removed the very word in many places and it seems much the same number of historians are employed in universities now as 2000' (Roe 2002–2003, 10).

Despite this, concerns about the state of history teaching at the university level have been raised in a number of subsequent reviews. In their study of undergraduate history curricula in Australian, New Zealand, Fijian and Papua New Guinean universities, Millar and Peel (2004, 14.2) found that 'curriculum change had been pushed by the presence and too often the loss of staff, and by attempts to respond to perceived changes in student demand. It has been more ad hoc than university teachers would like, and there are certainly major concerns about the role and place of history in university education more broadly'. The study found teaching programs tended to be driven by the changing expertise and capacity of staff, with hiring policies and formal review shaping but not determining the shape of curricular direction, resulting in a 'smorgasbord' approach rather than 'the deliberate creation of a coherent curriculum' (2004, 15–10).

One of the most frequent concerns identified in this review related to 'a lack of coherence and overall design in the history sequence, which might best be put as the problem of sorting out what constituted a fulfilling and complete major in history, and a lack of progression and inter-relationship between year levels.' (2004, 14.3). The paper noted concerns about reductions in the variety, number and coverage of subjects, which in some cases meant whole geographical areas had been abandoned. Under the new offerings, it was noted that few students would be able to construct a history sequence restricted to one nation or continent, although their ability to focus on a particular period of time, particularly modern history, had increased, and there was an increasing trend towards offering survey histories, rather than more specialised offerings. The study noted that the discipline was under strong pressure to respond to student demand and current trends in tailoring subject offerings, which meant that decisions tended to be made at a subject-by-subject level, rather than in overarching terms of the 'intellectual objectives of an entire sequence of studies' (2004, 14.9). A common complaint was about subject cutbacks, and the unsympathetic attitudes of government and university management towards humanities subjects. However, the study also reported that many participants indicated a 'slow but sure' recovery and suggested that program restructures have enabled more responsive and fluid curriculum structures.

Similar concerns have also been raised by Crotty and Eklund (2006). They report that service teaching arrangements, whereby history courses are offered as compulsory elements of professional degrees, are becoming increasingly common and attractive to historians for increasing enrolments. However, they advise that 'the principal danger of History as service teaching lies in allowing a creeping assumption to develop that History as a discipline is only ever important for vocational reasons. The traditional arguments about the intrinsic intellectual and

cultural value of History can be lost in an institutional environment where the discipline provides professional knowledge for professional degrees' (2006, 47.6).

In a follow-up review of honours and postgraduate programs in history, Millar and Peel (2007) found that honours programs continue to be seen as successful and worthwhile, although respondents noted that honours can be challenging for students, both in terms of isolation and in terms of the conceptual shift between broad undergraduate study and specialised and focused research. Some felt the program should place more emphasis on vocational outcomes, given the high numbers of students that do not continue with postgraduate study. The study reported concerns with student preparation for honours due to reduced prerequisites or deficiencies in the major sequence, particularly in terms of their familiarity with theoretical developments and historical methodology, including experience in working with primary documents. These concerns have also been emphasised by Hughes-Warrington et al. (2009) and Nye et al. (2009) who found that students associated their own study with secondary source rather than primary source material. As with the undergraduate courses, limited subject offerings, funding cuts and staff numbers remained critical concerns.

The primarily individualistic teaching culture of Australian history departments is also being challenged by increased management oversight of tertiary curriculum and imperatives to define curriculum in the language of standards and outcomes. Brawley et al. (2013) draw particular attention to the increasing prevalence of standards-based frameworks and emphasise the importance of engaging the disciplinary community in standards-based curriculum development. The disciplinary community were participants in earlier attempts at history standards development through the now rebranded Australian Learning and Teaching Council (ALTC), but such consultation is no longer an emphasis in more recent standards development through the Tertiary Education Quality Standards Agency (TEQSA) (and this has been identified as a concern by the AHA—see Lake 2011).

In the current climate, Brawley et al. (2013) argue that 'the history discipline's most urgent task lies in capacity building: in finding ways to record, model, demonstrate and evaluate what our history programs actually do. It can then build disciplinary consensus about standards definition by demonstrating the value of core disciplinary teaching practices, sharing knowledge about best practice teaching methods and showing the widespread use of best practice teaching methods in current history curricula'. In her earlier AHA address, Roe (2002–2003, 11) similarly argued that

> if we can't say [what is to be taught], someone else will, and doubtless get it wrong; and [...] we have a good story to tell. As educators historians are not offering subsets of skills but generic skills; and not specialised bodies of knowledge but viable routes into the common culture.

Overall, history in Australia is not faring badly in comparison to other HASS disciplines and has continued to maintain its traditional prominence. However, the discipline is being challenged by a range of recent developments particularly in terms of the politicisation of history and history teaching, changing emphases

in teaching resulting from heightened attention to outcomes and benchmarking, and the rise of more restrictive funding arrangements and audit regimes in universities.

Physics as a Discipline

There has been much investigation of physics from outside and within the discipline (for example Becher 1990; Bernstein 1996; Donald 2002; Doorman 1989; Galison 1997; Gaston 1973; Kitchener 1988; Knorr Cetina 1999; Penrose 2004; Wertheim 1995). The discipline is seen as one whose mission is to explore the building blocks and nature of matter and energy. It is often described as being among the oldest and most fundamental of the disciplines. The discipline arose out of natural philosophy, with important conceptual foundations concerning the use of mathematics to study natural phenomena being laid throughout the 16th and 17th century (see Gaukroger 2006). By the 19th century this was recognised as the distinct discipline of physics.

Physics is a large discipline that comprises a number of subdisciplines such as optical physics, condensed matter physics, particle physics, solid state physics and astrophysics. The boundaries between these subdisciplines are blurred, and equally the boundaries of the discipline intersect with many other disciplines. For example polymer physics and solid state physics have much in common with chemistry while other areas of physics such as quantum electrodynamics are highly mathematical. Physics also contributes to a range of interdisciplinary areas; biophysics in recent decades has become a large area of research as has nanotechnology. In the decadal plan put together by the Australian Institute of Physics and the Australian Academy of Science (Australian Academy of Science 2012), physics is described as underpinning disciplines such as engineering, computer science, chemistry and medicine.

It is the relationship between theory and observation that forms the basis of physics and its subdisciplines range from the highly theoretical to the more experimental. Theories are constructed and tested through mathematics, observation and experimentation. It is this central role of mathematics in physics that is seen by many as one of the distinguishing features that make physics different to other science disciplines (Bailly and Longo 2011; Dirac 1939). Mathematics plays a constitutive role for physics and the mathematical organisation of the physical world is a constitutive element of physics knowledge. Mathematics is the primary tool of theoretical physics providing a language of description for the physical world. There is rivalry between the theoretical and experimental subdisciplines and a hierarchy in which the more mathematical end of physics has typically been seen as superior by many physicists (Becher 1990).

The well-known typology developed by Biglan (1973a, b) labelled physics as ‘hard’. Physics aims to arrive at laws that are universal and used by all physicists forming a common knowledge base. ‘Hard’ as used by Biglan refers to a high

degree of paradigm consensus and also physics' reliance on quantitative modelling. Others have pointed out however that this consensus can be called in question at least periodically, due to the complex dynamics of scientific discovery and change, as occurred in fundamental manner in physics in the late 19th and early 20th century for example (see Kragh 2002; Kuhn 1977). Nevertheless, it is this relatively high degree of consensus and the way in which the laws and theories in the discipline build progressively on one another that led Bernstein (1996) to classify physics as having a strong hierarchical knowledge structure. Becher's (1990) study makes a similar point: that how this knowledge is built up can be seen in the relatively consistent order in which physics tends to be conceptualised and taught across institutions and countries.

Bernstein represents the knowledge structure of physics as a triangle where the aim of the discipline is to sharpen the tip through the integration or subsuming of theories while expanding the base to include a greater number of phenomena. The expanding base is visible as the discipline frequently pursues new research frontiers, many of them interdisciplinary. The tip represents what is often referred to as the 'theory of everything' that unites the fundamental forces of nature. This theory is yet to be discovered and is debated amongst the physics community with some saying that it is not possible while others claim that a universal law is no longer the distinguishing pursuit of the discipline (Callender 2010; Hawking 2002; Jaki 1966).

Becher's ethnographic account of academic physicists showed that among physicists there is 'a shared belief in the unity and simplicity of nature' (Becher 1990, 16). Physicists have a shared understanding, common language and a sense that non-physicists may not understand their subject matter. The belief by physicists that they have a 'rare and valuable set of skills' with which to solve the problems of natural phenomena leads to a sense of elitism and a community with comparatively strong 'camaraderie'. Discovery is presented as a process that does not necessarily occur in a coherent moment but rather takes time and relies on experience. There is often a sense of being 'right' and 'elegant' that comes with finding a solution to a problem.

While the biological and medical sciences appear to dominate national funding schemes and public discussions around the importance of science, particular aspects of physics are being drawn into collaborative projects of research in those fields and some areas of big discovery in physics itself still hold popular appeal. In recent years prominent areas of research have included some of the larger international collaborations such as the search for the Higgs boson particle at the Large Hadron Collider (LHC) built by researchers working at the European Organisation for Nuclear Research (CERN); and radio telescope arrays that require international collaboration such as the recent Square Kilometre Array (SKA) that involves ten member countries. Such collaborations require significant economic and personnel investment. Physics departments in Australia tend to draw the bulk of their research funding from the Australian Research Council (ARC). In recent years there has been a slight increase in research funding through this source to physics, particularly through the Large Infrastructure, Equipment and Facilities scheme

(Office of the Chief Scientist 2012). This reflects physics' dependence on expensive complex instruments for research.

Galison's (1997) sociological study of how physicists engage with ever bigger and more complicated instruments questions preconceived notions that physicists are insulated and not consultative in their research. He reveals the intense relationships and influences that data, computers and instruments have on science and on the cultures of those working with them. In Knorr-Cetina's (1999) decade-long ethnographic study of the epistemic culture of physicists working at CERN, she also discusses the strong dialogic relationship between researchers and the equipment that they use. This study demonstrates the complexity of the collaborative research process in large-scale experiments. Knorr Cetina argued that in the high level physics she was studying, the complex and multiple interactions of theory and equipment as foundations of new discovery mean not only that major developments here involve large numbers of researchers, globally distributed, but also produce an interest in the history of the decisions and developments that preceded the experiment, which may need to be retraced to uncover sources of error. It was noticeable as we visited physics departments in the course of this research that the history of the discipline and its key figures and developments was often prominent in visual displays.

As well as the large-scale collaboration and computing evident in high energy physics and astrophysics, physics continues to invest in smaller laboratory based and theoretical subdisciplines and interdisciplinary collaborations. Physics also continues to attract interest through popular public figures such as Professor Brian Cox and in Australia the recent (2011) Australian Nobel Prize winner for physics, Professor Brian Schmidt.

Physics in Australian Schools and Universities

Physics was selected as one of the two disciplines for investigation for this project because like history, physics has historically been seen as important and prestigious but over the past few decades has struggled to maintain student numbers at both the school and university level.

A 2012 report on the Health of Australian Science by the Office of the Chief Scientist identified physics as being both 'vulnerable' yet 'crucial' for Australia's future. Physics is often described as an enabling science alongside mathematics and chemistry and together these are seen to be crucial as they form the basic understanding required for scientific research. This follows views amongst many academic scientists that have long pushed for the importance of including these as 'foundational subjects in schooling', sentiments that are echoed in the Physics Decadal Plan (2012) developed by the Australian Academy of Science.

In the early and middle high school years of 7–10, physics is generally taught through a general science subject, although there is some variation, with

stand-alone physics subjects being taught at some schools. Also popular in recent years are electives or discrete subjects that focus on a particular science-related topic, for example forensic science or astronomy. The physics topics that must be covered in these years have historically been decided on by each state curriculum authority. This is now overlayed by the national Australian Curriculum, which was originally developed by an advisory committee led by Denis Goodrum and comprising a roughly even mix of academics, school representatives and departmental officials (the development of the Australian Curriculum via ACARA is discussed at more length in Chap. 5).

The states have adopted the science aspect of the Australian Curriculum to varying degrees. At the broad level the physics topics covered do not vary greatly across the states, with topics such as forces, energy, the particle model and electricity all being taught. The ways and extent to which these topics are taught do however vary, with different states and schools focussing on a range of themes, contexts and applications. The extent to which practical experimentation is used in the classroom also varies depending on the requirements of curriculum authorities and the knowledge and preferences of teachers teaching physics, as well as the different physical infrastructure of different schools. In these years all students will be taught some level of physics, as science remains a compulsory component of the Australian Curriculum up until the end of year 10.

Each state and territory in Australia has in the past had its own senior certificate course related to physics, and this has continued following the implementation of the Australian Curriculum. However the number of students taking physics at year 12 has been dropping. Between 1976 and 2007 the number of students taking physics as a percentage of the total number of students has dropped fairly steadily from 27.5 to 14.6 % (Ainley et al. 2008). The decline in student numbers has been attributed to a range of influences including a larger range of subjects being offered at this level and the perceived difficulty of the subject and how this relates to the 'utility value' of undertaking the subject (Lyons and Quinn 2010). Some have also suggested that it is related to physics at the senior secondary level no longer being a prerequisite for entrance into many university courses such as engineering and medicine as it was in the past (Office of the Chief Scientist 2012).

As discussed in the previous section, physics knowledge tends to be built up in a relatively consistent order and so physics is generally taught such that the same topics are revisited repeatedly over many years each time with an added degree of sophistication and often requiring an increasing degree of mathematical understanding. There are however examples of curricula that try to challenge this seemingly immutable approach to teaching physics (for example the Science Education Enrichment Project) and changes have occurred in the teaching of physics over the last half century.

The physics curriculum in the senior certificates has always been contested by a number of stakeholders including academics, government and of course the physics teachers themselves. By some accounts (e.g. Fensham 2012) there has been a shift away from academics and teachers having the greatest amount of influence on the physics curriculum towards a greater influence by educational bureaucrats.

This, it is argued by Fensham, is due to a market view of education where practitioners' expert contributions in curriculum development are taken only as advice rather than as the determining body for the curriculum framework.

In recent decades there has been a trend toward reducing the amount of mathematics in the senior secondary physics curriculum. This is seen to serve multiple purposes. Reducing the mathematical understanding required to complete physics reduces the need to take senior level mathematics as a co-requisite, thus opening up the possibility to attract a broader student group. This has occurred at the same time as a more constructivist approach to curriculum has resulted in a greater emphasis on students forming a better understanding of the core concepts in physics without the need to introduce the difficult mathematics that is often seen to cloud students' understanding. There is also a greater emphasis on including a range of physics related themes, contexts or applications in the curriculum in an effort to increase the perceived relevance and accessibility of the subject. In particular such theme-based topics are seen to engage female students. This more theme-based approach to teaching science, while not equally popular among those invested in curriculum decisions, has become increasingly popular since the late 1970s and reflects similar trends in many countries (Fensham 2012). This range of changes has led to what many call a 'dumbing down' of the curriculum, a change that is still debated among the many stakeholders.

There have been a range of efforts to increase the participation of girls in physics at all levels. At the school level a number of projects and reviews nationally and internationally have looked at this issue (for example the UK's Institute of Physics' commissioned study by Murphy and Whitelegg (2006) and have found a complex range of reasons why the number of girls undertaking postcompulsory physics is not increasing. In terms of curriculum issues, some research has shown that personal relevance has an influence on girls' curriculum choices (Murphy and Elwood 1998; Osborne and Collins 2000). This has led to some of the moves towards more theme, context or application based physics curricula mentioned above.

The issue with all curricula and curriculum changes is teachers' ability to have both the expertise to teach the content and the ability to make it engaging for students. The teaching of physics has received attention in recent years due to concern about whether those teaching physics are appropriately qualified. A 2005 report found that nearly 43 % of senior school physics teachers do not have a physics major and one in four had not studied the subject beyond first year university level (Harris et al. 2005). This is possibly related to the difficulty that the sector has had in recruiting science and in particular physics teachers since the early 2000s (MCEECDYA 2004) and the need to then draw teachers from other areas to teach physics subjects.

At the university level, while the number of students attending university has doubled in the last 20 years the number of students undertaking physics as a major and at honours level has fluctuated. Following a decline between 1993 and 2001 there has been an increase in the number of students taking physics at these levels although as a percentage of the student population this number has remained

largely flat (Sharma et al. 2009). Physics is the most unpopular of the natural and physical sciences taught at universities with only 5 % of those entering a science degree taking physics after the first year. Physics also continues to have difficulty attracting female students, who in 2010 made up only 24 % of the cohort. Female academics account for only 21 % of academic physics staff (Office of the Chief Scientist 2012).

As at the school level there is a great deal of overlap in the content offered in university physics curricula across the country. While a number of universities have offered majors in particular areas that are seen as popular such as nanoscience or more recently big data, in a recent submission by the Physics Committee of the Australian Academy of Science to the current Federal Government Review of Research Training it was suggested that 'there is little differentiation among Physics curricula at the undergraduate' level (National Committee for Physics, Australian Academy of Science 2015, 1). This submission instead suggested that differentiation in coursework tends to occur at the postgraduate level and generally reflects the research strengths of a particular department.

Physics departments across Australian universities vary in size, research focus and resources and many have gone through structural changes that have seen some departments diminish or be amalgamated with other departments (see O'Connor and Yates 2014). By many measures though research in the discipline in Australia is doing well (for example see ARC 2011). However there are some concerns from within physics about the number and quality of research students and an aging population of physicists. This is highlighted in the Decadal Plan for physics (Australian Academy of Science 2012) alongside a need to develop a more physics literate community. In order to replenish the physics departments and provide the community with greater physics literacy, the quality of physics teaching at all levels of education is seen to be key.

Conclusion

Although the humanities and the sciences are often contrasted with each other, physics and history have both similarities and differences in their positioning as disciplines and as components of education. They are both long established as core fields of higher education and to some extent of the school curriculum; they are, in Becher's (1989a, b) typology 'pure' fields, with knowledge creation rather than applied purposes as their central goal; they produce strong communities and disciplinary affiliation; they have been facing some challenges in the changing environment of higher education. In their contrasting characteristics, they are often included as exemplars of differences in the forms of knowledge of the physical sciences and the humanities: 'hard', vertical in structure, paradigm-centred, consensus-based and cumulative in the case of the sciences; 'soft', more horizontal in structure, with more fuzzy or implicit methodological norms and critical, creative and non-consensus purposes in the case of the humanities. But these typologies

are also quite sweeping generalisations that tend to look clearer from outside than from within each discipline.

Physics and history and their respective professional bodies in Australia have also been aware of and concerned about some of the changing environment they see in the first part of the 21st century, and have produced submissions and position reports to government responding to these. In the case of history there is concern about a move to learning and teaching standards for universities that take a form in which disciplinary judgement seems to have little part, and in relation to the school curriculum, a concern about the politicisation of the subject and its framing by governments. In the case of physics there is concern about diminishing numbers of students, both in schools and in universities, and about the fate of science research in Australia and the lack of understanding of physics in public discourse.

References

Abbott, A. (2001). *Chaos of disciplines*. Chicago: The University of Chicago Press.

Ainley, J., Kos, J., & Nicholas, M. (2008). Participation in science, mathematics and technology in Australian education. *ACER Research Monographs*, *4*.

Armitage, D. (2015). Horizons of history; space, time and the future of the past. *History Australia, 12*(1), 207–225.

Australian Academy of Science. (2012). *Physics Decadal Plan 2012–2021: Building on excellence in physics, underpinning Australia's future.* Canberra, ACT: Australian Academy of Science. Retrieved from https://www.science.org.au/sites/default/files/user-content/nc-physics-decadalplan_0.pdf

Australian Research Council (ARC). (2011). *Excellence in research for Australia (ERA) 2010 national report*. Canberra, ACT: Australian Research Council. Retrieved from http://archive.arc.gov.au/archive_files/ERA/2010/National%20Report/ERA_2010_National_Report.pdf

Bailly, F., & Longo, G. (2011). *Mathematics and the natural sciences: The physical singularity of life*. London: Imperial College Press.

Becher, T. (1989a). Historians on history. *Studies in Higher Education, 14*(3), 263–278.

Becher, T. (1989b). *Academic tribes and territories: Intellectual enquiry and the cultures of disciplines.* Milton Keynes, UK; Bristol, USA: Society for Research into Higher Education; Open University Press.

Becher, T. (1990). Physicists on physics. *Studies in Higher Education, 15*(1), 3–20.

Becher, T., & Trowler, P. (2001). *Academic tribes and territories: Intellectual enquiry and the culture of disciplines*. Buckingham, UK: Society for Research into Higher Education; Open University Press.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor and Francis.

Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3), 195–203.

Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 53*(3), 204–213.

Brawley, S., Clark, J., Dixon, C., Ford, L., Ross, S., Upton, S., et al. (2013). Learning outcomes assessment and History: TEQSA, the after standards project and the QA/QI challenge in Australia. *Arts and Humanities in Higher Education, 12*(1), 20–35.

Callender, C. (2010). Stephen Hawking says there's no theory of everything. *New Scientist, 207*(2777), 50.

Cannadine, D. (2002). *What is history now?* Houndmills, Basingstoke, Hampshire, New York: Palgrave Macmillan.
Carr, E. H. (1962). *What is history?* New York: Knopf.
Clark, A. (2006). *Teaching the nation: Politics and pedagogy in Australian history*. Carlton, VIC: Melbourne University Press.
Crotty, M., & Eklund, E. (2006). History as service teaching: Possibilities and pitfalls. *History Australia, 3*(2), 47.1–47.10.
Dirac, P. A. M. (1939). The relation between mathematics and physics. *Proceedings of the Royal Society Edinburgh*, *59*(II), 122.
Donald, J. G. (2002). *Learning to think: Disciplinary perspectives*. San Francisco: Jossey-Bass.
Doorman, S. J. (1989). *Images of science: Scientific practice and the public.* Aldershot: Gower Pub Co.
Dressel, P. L., & Mayhew, L. B. (1974). *Higher education as a field of study: The emergence of a profession*. San Francisco: Jossey-Bass.
Elton, G. R. (1968). *The practice of history*. New York: Crowell.
Fensham, P. J. (2012). The science curriculum: The decline of expertise and the rise of bureaucratise. *Journal of Curriculum Studies, 45*(2), 152–168.
Foreman, P. (1971). Weimar culture, causality, and quantum theory: Adaptation by German physicists and mathematicians to a hostile environment. *Historical Studies in the Physical Sciences, 3*, 1–115.
Galison, P. (1997). *Image and logic: A material culture of microphysics*. Chicago: University of Chicago Press.
Gardiner, J. (1988). *What is history today?* Atlantic Highlands, NJ: Humanities Press International.
Gaston, J. (1973). *Originality and competition in science: A study of the British high energy physics community*. Chicago: University of Chicago Press.
Gaukroger, S. (2006). *The emergence of a scientific culture: Science and the shaping of modernity, 1210-1685*. Oxford: Oxford University Press.
Harris, K. L., Jensz, F., & Baldwin, G. (2005). *Who's teaching science: Meeting the demand for qualified science teachers in Australian secondary schools. Report prepared for Australian Council of Deans of Science.* Melbourne, Victoria: Centre for the Study of Higher Education (CSHE). Retrieved from https://cshe.unimelb.edu.au/research/disciplines/docs/Prep_Math_Teach_Aust.pdf
Hawking, S. (2002). *Gödel and the end of physics.* http://www.damtp.cam.ac.uk/events/strings02/dirac/hawking/
Hirst, P. H. (1975). *Knowledge and the curriculum: A collection of philosophical papers*. London: Routledge.
Hughes-Warrington, M., Roe, J., Nye, A., Bailey, M., Peel, M., Russell, P., Laugeson, A., Deacon, D., Kiem, P., & Trent, F. (2009). *Historical thinking in higher education: An ALTC discipline-based initiative*. Strawberry, NSW: Australian Learning and Teaching Council (ALTC). Retrieved from http://www.theaha.org.au/historical-thinking-in-higher-education-final-report/
Jaki, S. L. (1966). *The relevance of physics*. Chicago: University of Chicago Press.
Jenkins, K., Morgan, A., & Munslow, A. (Eds.). (2007). *Manifestoes for history*. London: Routledge.
Jenkins, K. (2013). *At the limits of history: Essays on theory and practice*. Hoboken: Taylor and Francis.
Kagan, J. (2009). *The three cultures: Natural sciences, social sciences and the humanities in the 21st century*. Cambridge: Cambridge University Press.
Kitchener, R. F. (1988). *The world view of contemporary physics: Does it need a new metaphysics?* Albany, NY: SUNY Press.
Knorr-Cetina, K. (1999). *Epistemic cultures: How the sciences make knowledge*. Cambridge, MA: Harvard University Press.
Kragh, H. (2002). *Quantum generations: A history of physics in the twentieth century*. Princeton: Princeton University Press.

Kuhn, T. (1977). *The essential tension: Selected studies in scientific tradition and change*. Chicago: University of Chicago Press.

Lake, M. (2011). *Submission to the TEQSA discussion paper, June 2011, 'Developing a framework for teaching and learning standards in Australian higher education and the role of TEQSA'*. Australian Historical Association. Retrieved from http://www.theaha.org.au/wp-content/uploads/2015/06/TEQSA_Discussion_Paper-submission.pdf

Lyons, T., & Quinn, F. (2010). *Choosing science: Understanding the declines in senior high school science enrolments.* Armidale, NSW: University of New England.

Macintyre, S., & Clark, A. (2003). *The history wars*. Carlton, VIC: Melbourne University Press.

Maton, K. (2009). Cumulative and segmented learning: Exploring the role of curriculum structures in knowledge-building. *British Journal of Sociology of Education, 30*(1), 43–57.

MCEECDYA (Ministerial Council for Education, Early Childhood Development and Youth Affairs). (2004). *Demand and supply of primary and secondary teachers in Australia*. Retrieved from http://www.scseec.edu.au/site/DefaultSite/filesystem/documents/Reports%20and%20publications/Publications/Teachers%20and%20teaching/Demand%20and%20Supply%20of%20Primary%20and%20Secondary%20School%20Teachers%202003.pdf

Millar, C., & Peel, M. (2004). Canons old and new? The undergraduate history curriculum in 2004. *History Australia, 2*(1), 14.11–14.13.

Millar, C., & Peel, M. (2007). Vocational ventures and robust independence: A review of Honours and Postgraduate programs in History. *History Australia, 4*(2), 45.41–45.12.

Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.

Munslow, A. (2006). *Deconstructing history* (2nd ed.). London: Routledge.

Munslow, A. (2012). *A history of history*. New York: Routledge.

Murphy, P., & Elwood, J. (1998). Gendered experiences, choices and achievement: Exploring the links. *International Journal of Inclusive Education, 2*(2), 95–118.

Murphy, P., & Whitelegg, E. (2006). *Girls in the physics classroom: A review of the research on the participation of girls in physics.* Institute of Physics. Retrieved from http://www.iop.org/education/teacher/support/girls_physics/review/file_41599.pdf

National Committee for Physics, Australian Academy of Science. (2015). *Review of Australia's Research Training System—Consultation response form.* Retrieved from http://www.researchtrainingreview.org.au/submissions/submissions/

Neumann, R., Parry, S., & Becher, T. (2002). Teaching and learning in their disciplinary contexts: A conceptual analysis. *Studies in Higher Education, 27*(4), 405–418.

Neumann, R. (2009). Disciplinarity. In M. Tight, K. Ho Mok, J. Huisman & C. C. Morphew (Eds.), The routledge international handbook of higher education. New York: Routledge.

Nye, A., Hughes-Warrington, M., Roe, J., Russell, P., Peel, M., Deacon, D., & Kiem, P. (2009). Historical thinking in higher education: Staff and student perceptions of the nature of historical thinking. *History Australia, 6*(3), 73.71–73.16.

O'Connor, K., & Yates, L. (2014). Disciplinary representation on institutional websites: Changing knowledge, changing power? *Journal of Educational Administration and History, 46*(1), 1–16.

Office of the Chief Scientist. (2012). *Health of Australian science.* Canberra, ACT: Australian Government. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/HASReport_Web-Update_200912.pdf

Osborne, J., & Collins, S. (2000). Pupils' and parents' views of the school science curriculum. *School Science Review, 82*(298), 23–31.

Pascoe, R. (2003). *The lettered country*. Canberra, ACT: Australian Universities Teaching Committee.

Penrose, R. (2004). *The road to reality: A complete guide to the physical universe*. London: Jonathan Cape.

Phenix, P. H. (1964). *Realms of meaning* (Vol. 5). New York: McGraw-Hill.

Preiss, B., & Butt, C. (2013, October 5). Passion for Australia's past becomes history, *The Age*. Retrieved from http://www.theage.com.au/national/passion-for-australias-past-becomes-history-20131004-2uzy9.html

Roe, J. (2002–2003). History at the crossroads? Presidential address 2002. *Bulletin (Australian Historical Association)*, *95*, 3–13.

Scheffler, I. (1965). Philosophical models of teaching. *Harvard Educational Review, 35*(2), 131–143.

Schwab, J. J. (1962). The concept of the structure of a discipline. *Educational Record, 43*, 197–205.

Schwab, J. J. (1978). *Education and the structure of the disciplines*. Chicago: University of Chicago Press.

Sharma, M., Swan, G., Mills, D., Pollard, J., Mendez, A., & O'Byrne, J. (2009). Physics learning and teaching in Australian Universities. *CAL-Laborate, 17*(1), 26–40.

Snow, C. P. (1959). *The two cultures and the scientific revolution (the Sir Robert Rede Lecture)*. Cambridge: Cambridge University Press.

Swoboda, W. W. (1979). Disciplines and interdisciplinarity: A historical perspective. In J. J. Kockelmans (Ed.), *Interdisciplinarity and higher education* (pp. 49–92). University Park, Pennsylvania: Penn State University Press.

Taylor, T. (2000). *The future of the past: Final report of the national inquiry into school history*. Melbourne: Monash University.

Taylor, T., & Clark, A. (2006). *An overview of the teaching and learning of Australian history in Schools*. Canberra: Department of Education Science and Technology.

Taylor, T., & Guyver, R. (Eds.). (2012). *History wars and the classroom: Global perspectives*. Charlott, North Carolina: Information Age Publishing.

Turner, G., & Brass, K. (2014). *Mapping the humanities, arts and social sciences in Australia.* Canberra: Australian Academy of the Humanities. Retrieved from http://www.humanities.org.au/PolicyResearch/Research/MappingtheHumanitiesArtsSocialSciences.aspx

Victorian Curriculum and Assessment Authority (VCAA). (2013). Proposed directions: Review of VCE English, History, Mathematics and Science studies. Discussion paper. Melbourne, Victoria: VCAA. Retrieved from http://www.vcaa.vic.edu.au/documents/vce/vceconsult/proposed-directions-review-of-english-history-maths-and-science-discussion-paper.pdf

Wertheim, M. (1995). *Pythagoras' trousers: God, physics, and the gender wars fourth estate*. New York: Times Books/Random House.

Winch, P. (1958). *The idea of a social science and its relation to philosophy*. London: Routledge & Kegan Paul.

Yates, L., Collins, C. & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: State cultures and the big issues.* Carlton, VIC: Melbourne University Press.

Chapter 4
New Public Management and the Changing Governance of Universities

In recent decades, the national and institutional governance systems coordinating the core knowledge activities at Australian universities have undergone significant change. In this chapter we outline the major dimensions of these changes as well as the ideas and conceptions associated with them. We begin by briefly exploring broader shifts in dominant political ideas concerning the place and purpose of the modern university, and associated shifts in policy ideals concerning the adequate means of governing universities and their work that have taken place in Australia and elsewhere. We then discuss some of the specific changes in the system-level governance of Australian universities, and outline how these relate to the core university activities of teaching and research. Finally, we discuss major developments that have taken place on the level of institutional governance and the management of academic work, and their relevance for the research on history and physics that is discussed in subsequent sections of this book.

Changing Political Ideas about Universities

One major change in the way universities are viewed in the political arena is the rise of the conception of higher education as an 'industry' (see Gumport 2000; Marginson and Considine 2000). This conception has mostly although not completely been superimposed over the more traditional and value-laden notion of the university as a social institution. The 'industry' conception holds that contemporary universities essentially are corporate organisations competing in the domestic and international service economy for fee-paying students and other potential sources of revenue. It further emphasises that universities' research activities ought to be guided by economic or even commercial agendas, thus entailing a decidedly utilitarian view of universities and of the roles they play in and for society.

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The shift toward conceiving higher education primarily in more utilitarian terms, as an industry, is by no means restricted to Australia. However, one aspect that is particularly strongly emphasised in Australia is the economic role higher education plays as an 'export industry' earning substantial revenue, mainly in the form of tuition fees that are charged to international students. These fees make up to a significant extent for the shortfall in public funds provided to universities (see below). Symptomatic in this regard is that the Australian universities in their public communications tend to actively stress their own role as an export industry when outlining their contribution to society, while being almost shy of making references to the more traditional idea that universities as institutions also work toward epistemic and also normative ends and purposes.

Broadly associated with this shift toward perceiving universities in more utilitarian terms has been the rise of an influential body of ideas that has significantly shaped national higher education policy and governance in Australia. This body of ideas is in the literature commonly referred to as New Public Management (NPM). NPM is by no means a coherent and static body of principles (see Christensen 2011; Hood and Peters 2004). But there are nevertheless some defining conceptual elements, including the core idea that a greater governance focus on market-based forms of competition, along with the use of formal performance measurement and management techniques, will lead to improvements in the accountability and efficiency of public organisations including universities. A specific emphasis is placed on the use of formal measurement systems to evaluate performances and to distribute funding according to results (or rather outputs) achieved. More often than not, this evaluative procedure is then also used for the production and publication of performance rankings as a particular instance of public accounting (Weingart and Maasen 2007). At the same time, NPM advocates the devolution of managerial responsibilities for budgeting and staffing to the public organisations whose activities are funded, thus making these organisations more 'autonomous' and directly responsible for their actions and results achieved.

Public administration reforms that were inspired by NPM principles and ideas swept throughout the Anglosphere from the 1980s onward, and subsequently, to various degrees, throughout much of the rest of the world (see Ferlie et al. 1996; Hood and Peters 2004; Pollitt and Bouckaert 2004). These reforms have had a considerable and lasting transformative impact on governance and funding arrangements for public universities (see for example, Bleiklie and Michelsen 2012; De Boer et al. 2007; Lorenz 2012). Despite differences in country-specific adaptations of NPM ideas, there was a shared political and policy ambition driving these reforms, namely to increase the efficiency and accountability of public universities and their operations, a particular emphasis being placed on the fact that 'value is delivered for money'.

In broader alignment with the shift toward seeing higher education as an industry, this policy focus on efficiency seems to have marginalised more fundamental considerations regarding the effectiveness of universities, that is, the substantive results or goals of their activities (see Lorenz 2012, 604). In the context of NPM-style policies, this is also epitomised by the emphasis that is typically placed on

'outputs' rather than on 'outcomes'—which in turn is reflected in the prominent role given to governance mechanisms that allocate funds to Australian universities in line with the number of outputs achieved (discussed further below).

Australia's pioneering role in radically reforming the governance of its public universities in accordance with NPM principles has been widely noted in the literature (see for example, Beerkens 2013; Hicks 2012; Marginson 1997; Marginson and Considine 2000). Australia in many respects went further and was more persistent than many other governments in reorganising the governance and funding of its public universities along principles that are at the heart of the NPM reform agenda.

One example of this is the extent to which the public funds that are given to universities to support their research activities have become performance-based—and, in line with what we have said above, performance-based in the sense that the volume of output is almost always prioritised over those qualitative aspects of outputs that may be harder to measure (Geuna and Martin 2003, 293–294; Woelert and Yates 2015). Another example is the progressive proliferation of formal and consequential mechanisms for the measurement and monitoring of universities' performances, and where performance data are published to establish national rankings.

These formal mechanisms constitute a system of performance-based governance that, it would appear, has been caught in a peculiar dynamic of escalation (Pollitt 2013; Woelert 2015). In this dynamic, performance measurement tends to become operationally increasingly complex and expansive, and, in political terms, control-focused. One striking illustration of this is the fact that there now exist two incommensurable performance reporting and auditing mechanisms for university-based research activities in Australia, one being associated with the 'Excellence in Research for Australia' evaluation exercise (ERA) conducted every two to three years, the other one being the comprehensive annual research performance reporting mechanism that determines block-grant funding for research activities (see Woelert and Yates 2015, 182).

In the broader picture, Power (1997) has regarded this type of proliferation of formal performance measurement and monitoring mechanisms as being symptomatic of the rise of the 'audit society'—a society in which auditing has become a guiding principle of social organisation and control. In his analyses, Power (1997, 4) regards audit as a 'particular style of formalized accountability' that involves rationalising activities and their results, and which is based upon the idea of 'answerability for performance' (Romzek 2000, 22). The rendering of activities and their results into a limited set of clearly defined and measurable performance criteria is central to the practice of audit.

'Audit' has both an operational and a normative-political dimension (Power 1997). In operational terms, audit mobilises a range of rational technologies of checking and control, most of which have their basis in long-established techniques of financial auditing. And in political terms, 'audit' is commonly constituted as a purposeful and legitimate idea on the basis of its claims to 'enhance transparency and accountability' of organisations (including universities) and their

operations (Shore 2008, 278). In actual practice, however, the relationship between both the operational and political elements of audit can be rather messy and cumbersome. Often the broader political expectations driving auditing practices are far removed from the actual capacities of those practices to deliver on those expectations (Power 1997, 7). Furthermore, the same practices also may have a range of unintended effects on organisations like universities and on the individuals working in them (see Woelert and Yates 2015).

The proliferation of practices of audit as well as of a political discourse of accountability is indicative of eroding trust among government and policy-makers in the university and its professional members of staff (see Huisman and Currie 2004; Vidovich and Currie 2011; Weingart 2013). The new political dogma in countries such as Australia appears to be that universities as well as the academics working in them require a more hands-on 'managerial' regime using 'carrots and sticks' to improve performances (see Lewis 2013, 72–73). Similarly, in the policy discourse, traditional modes of academic knowledge production have come to be commonly regarded as too 'esoteric' (Weingart 2013, 89) to be capable of addressing urgent societal, economic and environmental needs.

The System-Level Governance of Universities in Australia

As noted above, the national governance system for universities in Australia has undergone significant change over recent decades, with Australia being one of the protagonists internationally of reorganising its university policy and governance arrangements along NPM lines. The Dawkins higher education policy reforms—named after the Labor Education minister John Dawkins and taking place in 1987–1989—are generally considered the watershed point in this regard. Subsequent federal governments—both Labor and Coalition—have generally continued the path that was set with these reforms (see Croucher et al. 2013; Marginson and Considine 2000).

The Dawkins reforms were motivated by a number of aims perceived to be of vital economic importance by the Australian government at the time. Firstly, they were intended to overcome perceived inefficiencies in the Australian higher education system. This was in the main meant to be achieved through creating 'economies of scale' through institutional mergers and through creating an environment where universities had to compete for funds, and be funded on the basis of their 'performance'. On this basis, the reforms were, secondly, intended to create conditions allowing for a drastic expansion of the provision of university education to the Australian populace. This was to generate the future employees for the emerging 'knowledge economy' at a manageable cost. Thirdly, the reforms were conceived to increase the accountability of universities to government, through increased and more detailed reporting requirements. Another explicit goal of the higher education reforms was to increase diversity in university

mission and profile; although recent empirical research suggests that the opposite effect occurred (Croucher and Woelert 2016). At least with regard to the goal of expanding university provision, the Dawkins reforms have proven to be enduringly successful: since the Dawkins reforms, participation rates in Australian higher education have increased substantially, as has the average size of the Australian university (see Norton and Cherastidtham 2014).

The Dawkins reforms were seen as controversial at the time (and continue to be), particularly by the eight well-established, research-intensive universities that later became the members of the Group of Eight (Go8). Particularly controversial was the creation of a 'Unified National System' of higher education (UNS). Prior to 1989 the Australian higher education system comprised two dominant forms of institution, one being the 19 universities, another being the more vocationally orientated 46 Colleges of Advanced Education (CAE).[1] Two years later, after a range of institutional mergers, there existed 31 universities in Australia and no single CAE (see Croucher and Woelert 2016).

Some—notably the established, research-intensive universities—considered the creation of a unitary higher education system (and the expansion of university provision associated with it) as entailing a devaluing of traditional forms of university education and academic knowledge. Such critique has to be seen in the context that it was precisely the established universities that had the most to lose from the reforms. As a result of the creation of the UNS they now faced increased competition both for students and research funds, and a national financial cake divided up between many more institutions.

In terms of actual governance arrangements, the Dawkins reforms instigated a significant shift toward what is referred to in the policy whitepaper as a 'funding system that responds to institutional performance and the achievement of mutually agreed goals', and where funds are allocated on the basis of 'a range of output, quality and performance measures' (Dawkins 1988, 85). One immediate consequence of this shift was the creation of a research funding system that more strongly emphasised competitive processes in the form of research grants instead of recurrent funding streams. At the same time, there was an expectation that within the expanded higher education system, all academics in all universities would be both researchers and teachers, whereas many in the CAEs and some in the universities had previously not undertaken research at all (Larkins and Croucher 2013). This created a condition where the established universities could no longer take their research funding simply for granted, although in practice they continued to be awarded the bulk of research funding provided by the federal government.

[1]There was also a technical and further education sector, TAFE, which was left in place by the initial reforms, but has subsequently also been both opened up to greater market forces, and also in some cases able to operate across the higher education boundary.

Since these initial reforms, this trend toward allocation of public funds to Australian universities on the basis of reported performances against a range of output measures has progressed considerably, particularly in the allocation of research funds. At the same time, overall public funding provided to Australian universities has decreased progressively and to a significant extent. In 1987, just prior to the Dawkins reforms, 85 % of the overall revenue of Australian universities came, in one form or another, from the Australian government (Marginson 1997, 68). By 2013, this figure had dropped to just below 45 % (Department of Education 2014, 3).

Concomitant with the reduction in public funding, the Dawkins reforms also re-introduced capped tuition fees for domestic students attending universities, thus shifting some of the costs of tuition back onto the student body. The same reforms also encouraged Australian universities to internationalise their student body, as international student fees were left uncapped and thus assumed growing strategic importance as a substitute stream of revenue (these fees now make up around 25 % of university revenue on average).

Notwithstanding the reduction in funding provided to its universities, the Australian federal government has in many important respects increased its control over university-based knowledge activities. One crucial development was the abolition in 1987 of the Commonwealth Tertiary Education Commission (CTEC). Prior to its disestablishment, CTEC served as an intermediary body that was relatively autonomous from government, providing expert policy advice on matters of university teaching, research and funding (see Meek 1991). Motivating this step was the ambition of John Dawkins to bring Australian universities and their activities under a more direct form of ministerial control, to enable swift and complete realisation of his higher education reform agenda.

It is no coincidence that in the same year a centrally administered, governmental research funding body—the Australian Research Council (ARC)—was created. In the Australian context, the ARC is responsible for providing grants for basic and applied research activities in all fields except those undertaken with a clinical direction in medicine and dentistry.[2] Most of the history and physics research undertaken at Australian universities is funded through the ARC. The creation of the ARC served the purpose of allocating an increasing proportion of research funds on a competitive basis rather than via the recurrent funding of universities.

But in addition, the creation of the ARC also gave the Australian federal government greater control over the *substance* of research conducted at Australian universities (see Whitley 2011). This was achieved through the setting of national research objectives and priority areas that receive preference in the allocation of research grants, as well as through the creation of new funding schemes directly

[2]Responsibility for competition-based research funding for the latter fields is with the National Health and Medical Research Council (NHMRC), which was formed in 1937 and gained the status of an independent statutory agency in 1992 (Larkins 2011, 168).

aimed at problem-orientated and applied modes of research involving collaboration with industry partners.[3] Compounding the degree of centralised governmental control over the broad direction and allocation of research funding is the fact that Australia has by international standards an unusually sparse research funding landscape in terms of diversity of funding sources. In Australia, university-based researchers working in fundamental disciplines such as history and physics have in the main only one national source to go to for comprehensive funding for basic research—the ARC. This contrasts markedly with situation in the USA and in many European countries, for example, where there are multiple funding bodies and also a range of private foundations supporting basic research.

The Dawkins reforms were meant to reduce direct and overt governmental regulation of university internal procedures and processes, instead using a host of performance-based governance mechanisms with clear financial implications to steer and control universities more remotely (see Marginson 1997). The actual governance processes that have however developed from these reforms in Australia are in their form rather centralised and top-down by international standards.

In the national governance of Australian universities, the central authorities—i.e. the federal government—generally set the 'rules of the game' by determining in a top-down manner the relevant performance criteria and standards against which all universities are evaluated and, ultimately, funded (Marginson 1997, 65). This centralisation is allied with a strong propensity among the relevant Australian authorities to rely on 'one-size-fits-all' quantitative indicators for the assessment of each individual university's performance; the operational advantage of such indicators being that they can be applied 'by a central authority uniformly across a large number of disparate domains' such as different institutions or knowledge domains (Woelert and Yates 2015, 180; see also Butler 2003; Gläser and Laudel 2007).

This steering through performance-based governance mechanisms has been particularly heavy-handed in the sphere of university-based research activities (Gläser and Laudel 2007; Hicks 2012; Woelert 2015). Australia has by no means been the only country to move toward a performance-based research funding system for its universities, where funding allocations are tied to performance against a set of quantitative performance indicators. However, it is an outlier internationally in that it has made the entirety of recurrent research funding (as opposed to competitive research grant funding) performance-based, using an indicator-based funding formula to distribute funds to universities 'without any further consideration' (Gläser and Laudel 2007, 127). The key performance indicators being used at present are the number of research publications, external research income, and the number of students undertaking and completing research degrees over the two most recent years.

[3]Some of this increase in substantive steering control may however have been symbolic rather than actual. This is because both individual researchers and their institutions can be quite imaginative in circumventing overt steering attempts by government, for example, through various 'window-dressing' exercises (see Krücken 2014, 1444).

Quantitative performance indicators also play a crucial role in the national research assessment initiative, 'Excellence in Research for Australia' (ERA). ERA was established in 2010 by the then Labor government and continued under subsequent governments. In line with national research assessment in other countries such as New Zealand, the UK and Hong Kong, ERA's ostensible aim is to determine the quality or 'excellence' of research undertaken at universities, as opposed to levels of research productivity which is already determined and checked through regular annual reporting mechanisms. ERA makes use of some peer review for its assessments, both direct in the case of designated 'peer review' disciplines, and in its use of some academic assessment panels to review the quantitative data. By and large however the ERA assessment to date relies more strongly on quantitative indicators and output measures than comparable initiatives in other countries such as the UK and New Zealand, which extensively use in-depth analysis of selected publications (see Woelert and Yates 2015). Indeed, the ERA assessment guidelines explicitly state that appropriate indicators for assessing the 'quality' of research activities must be 'quantitative', that is, 'objective measures that meet a defined methodology that will reliably produce the same result, regardless of when and by whom the principles are applied' (Australian Research Council 2012, 1).

The situation concerning the system-level governance of universities' teaching activities is a little different to that concerning research. Due to a range of factors, university-based teaching activities have in the main been governed by regulatory and quality assurance mechanisms. Governmental attempts to establish an output-focused, performance-based governance and funding mechanism for undergraduate teaching have been half-hearted, at least if compared to the more sweeping changes in the domain of research policy and funding (see Norton et al. 2013). At present, those public funds devoted to supporting university-based teaching remain in the main tied to an input indicator, namely the number of students attending a course, and also take into account the costs associated with the delivery of teaching in various disciplines. Alternative plans to tie funding more closely to output indicators such as the number of graduating students or, however vague, notions of the 'quality' of graduates, have been dropped, possibly due to perceived difficulties.

This contrasts markedly with developments in the area of doctoral 'research training'—an area in which output measures and attention to substantive quality have had ongoing attention. The training of doctoral students has been under considerable scrutiny internationally in recent decades as national governments increasingly associate higher education with the economic opportunities of a 'knowledge economy'. In Australia this new scrutiny and the associated wave of policy reforms is particularly dated from a *Knowledge and Innovation* white paper produced in Kemp (1999) by the then Minister for Employment, Education, Training and Youth Affairs, Dr David Kemp. An initial target of this paper was perceived problems of efficiency in PhD programs in Australian universities. Two areas of particular concern were the length of the doctoral program and attrition rates of students. Subsequent introduction in 2001 of a Research Training Scheme

changed the funding model for universities to one weighted heavily (70 %) to output—that is, 'timely completion'—rather than intake numbers (see Neumann 2009). A recurrent focus of the efficiency and knowledge economy discussions is the question of desirable numbers of doctoral students in Australia, with periodic concerns both about undersupply and oversupply.

In terms of 'quality' in doctoral training, the focus of the Australian policy documents has been particularly with employability. Here a range of reports have taken up employers' perceptions of skills deficiency (for example, Allen Consulting Group 2010; DIISR 2011a, b), and advanced the view that there has been too little focus on wider career planning, and on 'generic' attributes in the traditional doctoral form of study. They advocate new attention to written and oral communication, flexibility, teamwork, entrepreneurship and problem-solving skills in doctoral programs. These reports have broadly been supported by university sector submissions, and, as described by Cutherbert and Molla (2014), have produced a number of changes to doctoral programs. However, these authors see three major problems with 'crisis' policy rhetoric surrounding the Australian PhD: (1) the assumption has been that the deficits are in the graduates and the university programs: there has been little attention to whether industry in Australia is 'PhD ready'; (2) there is little attention to what is gained and lost by moving the PhD away from a purpose of discovery of new knowledge for its own sake; and (3) the issue of how to produce ever more internationally competitive research quality and talent in the global higher education market while becoming more and more efficient is an under-recognised challenge, at least at the policy level. In later chapters of this book we hear some views of historians and physicists on this changing context of doctoral student supervision.

One major governance change to university undergraduate programs has been the creation of a demand-driven system of higher education over the years 2010–12. The creation of this system was recommended by the *Review of Australian Higher Education*, the so-called Bradley Review (2008), and fitted within the broader competitive market-based trajectory of reform established by Minister Dawkins twenty years earlier. With the creation of the demand-driven system universities have attained considerable leeway over their student enrolment numbers, whereas these were more strictly regulated before. This deregulation effort was accompanied by increased governmental oversight of university-based teaching through the strengthening of quality assurance (QA) bodies and mechanisms, which in turn have created additional regulatory detail and reporting requirements (see Vidovich 2012).

Of particular importance in this regard has been the creation of the Tertiary Education Quality and Standards Agency (TEQSA) in 2011. TEQSA is a government-funded regulation and QA body that replaced the Australian Universities Quality Agency (AUQA) established in 2000. AUQA in turn is the successor of the Committee for Quality Assurance in Higher Education (CQAHE) which was established in 1993 to administer, implement and refine QA policies initially conceived of by the responsible federal ministry. Several important trends in the evolution of these QA bodies and their mechanisms have been noted. These

include an increasing concern with standards for qualifications, teaching and other associated services, an emphasis on external rather than university-internal forms of accountability as well as a transition from qualitative to quantitative measures (see Vidovich 2012). Both AUQA and now TEQSA have the power to audit individual universities and assess the 'risks' associated with their provision of education. One important difference between TEQSA and AUQA is however TEQSA's responsibility for the whole of the higher education sector—that is, including private providers of various kinds—and not just for universities.

The attempt to charge one QA body with regulating and auditing quality in teaching and learning across all institutions and fields of study tends to involve considerable standardisation of criteria and mechanisms of assessment. This has attracted the criticism of disciplinary groupings and associations. For example, a submission made by the Australian Historical Association (AHA) to the TEQSA discussion paper on 'Developing a Framework for Teaching and Learning Standards in Australian Higher Education' notes a number of concerns about the 'domination' of the Standards Panel by representatives 'with little or no engagement with the scholarship of teaching and learning in specific disciplines' (Lake 2011, 2). This submission is further highly critical of the marginalisation of disciplinary communities and expertise in the proposed judgment of quality:

> Beyond a few vague statements […] the document as a whole is surprisingly neglectful of the proper place of the discipline communities in standards formulation and verification process. […] The AHA is of the view that the proposed Standards Panel should not be dominated by senior university executives with little or no engagement with the scholarship of teaching and learning in specific disciplines. If this happens TEQSA will replicate the major difficulties that the British system confronted in the wake of the Dearing Report of 1997. The AHA believes that the Standards Panel should comprise persons recognized as authorities in particular disciplines.
>
> (Lake 2011, 2)

The AHA submission is similarly critical of the TEQSA discussion paper in terms of the kinds of generic thinking it seems to embed about quality. This includes its failure to recognise that different criteria are involved in determining, for example, what is needed to meet a Qualifications Framework type of standard for quality of the multi-disciplinary Bachelor of Arts as compared with judging the adequacy of the quality of a major within this broader discipline area, or judging what is required to be qualified in a subject like history. The submission is critical too of this Panel's search for generic output measures of student quality such as 'critical thinking':

> The Paper relies on outdated ideas about 'generic skills'. Critical thinking, for example, is not a 'generic skill'. Rather it is translated in different ways in different disciplinary contexts to particular questions. One does not critically think about nothing.
>
> (Lake 2011, 6)

In summary, since the late 1980s, Australian federal governments have been pursuing an approach to governing their universities that strongly embraces performance-based forms of control and audit to monitor and steer universities and their

core activities—while at the same reducing universities' public funding. This has led to the establishment of a national governance system that is by international standards quite centralised and heavy-handed. This development has been more pronounced with regard to universities' research than to teaching activities. With regard to the latter activities, recent shifts in system-level governance have seen a dynamic of de- and reregulation, with governmental control of student allocations having diminished but regulatory oversight through quality assurance mechanisms increased. Both in research assessment and in the search for teaching and learning standards, one can identify a common trend toward the use of more standardised and more generic forms of assessment and accountability than those which are attuned to different fields and forms of knowledge.

Institutional Governance and Management

Since the Dawkins reforms, Australian universities have undergone substantial change in governance, management and organisational form (Croucher et al. 2013; Croucher and Woelert 2016; Forsyth 2014; Marginson and Considine 2000). Some of these changes can be directly related to the radical shifts in system-level policy, governance and funding outlined above, others may reflect broader societal, economic and technological dynamics impacting upon universities worldwide. The most important changes at the institutional level can be outlined as follows.

In the wake of the Dawkins reforms, Australian universities have sought to expand and strengthen their executive centre, establishing a more managerial governance regime with clear hierarchies and accountabilities. As a result of this shift, Vice-Chancellors turned into corporate leaders, with a range of additional executive leadership roles for various portfolios such as research and international affairs being created (see Forsyth 2014). This executive centre has taken up considerable managerial control and decision-making functions across the entire university. For example, in the typical Australian university the executive centre has the power and authority to retain significant amounts of external funds for making more strategic allocations internally, thus responding to the common policy ideal of turning universities into more integrated, strategically operating organisations (Weingart and Maasen 2007; Whitley 2008). This transformation is considered necessary for making universities responsive to the realities of a new, increasingly globalised environment in which funding is scarce, and competition for students and quality staff fierce.

Concurrent with the trend toward creating a stronger central executive, universities have sought to devolve particular administrative and budgetary responsibilities to the periphery, that is, to the various faculties or schools within the university. Mirroring system-level arrangements, the centre then exercises its steering power 'at a distance', through allocating resources internally on the basis of performances as measured against a set of performance indicators. These institutional indicators usually align closely with those indicators that the Australian

government uses for research funding purposes across the entire university sector. It is plausible to assume that this mimicking of indicators has its ground in the institutional ambition to maximise external, performance-based revenue. However, it may also be motivated, at least in part, by political concerns, for the internal distribution of 'resources 'as earned' is the one that is easiest to legitimise in the internal struggle for resources' (see Gläser et al. 2010, 298).

Along with the strengthening of the central executive, the development of performance-based resource allocation mechanisms, and the rise of a more managerial culture within Australian universities, long-established modes of academic self-governance have been weakened (see Marginson and Considine 2000). This trend pertains not merely to administrative matters, but also to core academic activities such as teaching and research, both of which are more tightly controlled and steered from the executive centre than has been the case in former times. Finally, and mirroring a general trend around the world (Enders et al. 2013; Henkel 2005), the professional autonomy of academics working at Australian universities has decreased. In the present context, considerations about the proper epistemic and normative role and function of academic autonomy have been mostly superseded by considerations about how to best utilise the increased autonomy that universities have attained over the conduct of their own managerial affairs.

It has been claimed, most prominently by Marginson and Considine (2000), that such degradation of academic forms of governance has implied a weakening of the standing of the academic disciplines at Australian universities. These authors predicted a continuing trend toward interdisciplinary and multi-disciplinary centres and groups replacing the traditional discipline-based schools and faculties at the institutional level (Marginson and Considine 2000). Precisely such development toward more interdisciplinary forms has also been consistently called for in various governmental policies and strategies papers over the last decade or two (see Woelert and Millar 2013). In these documents, the demand for interdisciplinarity is based upon criticisms that the traditional disciplinary structure of knowledge production is overly self-referential, thus hindering universities to effectively engage with the pressing problems and concerns of contemporary society (see Weingart 2013). This said, some have also argued that the push for interdisciplinarity at work in Australia and elsewhere has some of its roots in the politically motivated distrust of the academic professions that is inherent in the NPM policy agenda (see Lorenz 2012).

The actual picture emerging with regard to the recent changes in the organisational structure and institutional standing of the academic disciplines at Australian universities is however a complex one. On the one hand, there is indeed evidence that the individual disciplines within Australian universities have lost some of their traditional role as the major organising principle for the structure of the university. There has been an evident decline of the stand-alone, single-discipline department within Australian universities, and a trend toward the creation of larger academic organisational groupings housing several disciplines. This shift toward mixed and larger units may indeed mean that the power of the disciplinary voice in the

organisational affairs of the university is reduced. More specifically, in relation to the disciplines that are the focus of this book, we discovered in setting up our study that in 2011, there remained only two stand-alone history departments and seven stand-alone physics departments across all 39 Australian universities. By comparison, in 1997, the respective numbers were ten and sixteen, out of the 32 universities for which data was available (O'Connor and Yates 2014).

While the decline of stand-alone departments of well-established disciplines such as physics and history is a telling development, there are fewer indications as yet that this decline also signals a broader transition toward specifically interdisciplinary modes. To this day the major trend at Australian universities has been toward housing individual disciplines within bigger 'multi-disciplinary' groupings, rather than toward a structure in which interdisciplinary centres and programs constitute the most prominent organisational unit. This suggests that the relative decline of the traditional, single-discipline department in Australian universities may be primarily motivated by pragmatic concerns to create 'economies of scale' rather than by a motivation to truly bed down interdisciplinarity organisationally. Interesting, too, in this context is that the immediate aftermath of the Dawkins reforms saw in fact a decline of more unorthodox organisational forms including more interdisciplinary academic groupings at Australian universities, with several more 'innovative' universities instead transitioning toward the faculty-department model associated with the more traditional, research-intensive universities (Croucher and Woelert 2016).

Further complicating the picture is another development. Both the Australian competitive grant system and the ERA research assessment have been criticised for their core organisation around disciplinary classifications and forms of peer judgment that create difficulties for interdisciplinary research (see Bammer 2012; Woelert and Millar 2013). At the university level, the same discipline-based system of classification is commonly used for internally managing research activities as well as for external and internal reporting requirements. Moreover, there has also been some institutional reinforcement of the disciplines for reputational reasons, as a result of the various international university ranking exercises being strongly geared toward disciplinary research output and esteem measures. These rankings are usually taken very seriously by university management for marketing purposes, and are also commonly referred to by policy-makers to highlight the relative performance of Australia's university sector.

Implications for History and Physics

In the preceding discussions we have outlined some of the more recent changes in the broader political, policy and governance contexts in which Australian universities operate. We have illustrated how specific system-level policy and governance mechanisms target and monitor university activities such as research and teaching, including the financial levers employed by the Australian government to

achieve the desired steering effects. We have also illustrated how these system-level changes articulate on the level of individual institutions in the form of a more centralised management structure and of competitive processes for the internal allocation of funds.

It is clear that these changes have transformed the conditions for academic knowledge work at Australian universities both structurally and materially. In structural terms, there are greater political pressures now on the academic disciplines to demonstrate relevance and socio-economic impact as well as research income success against other parts of the university. Yet at the same time, as a result of the proliferation of national and international rankings, there is also pressure on academic groupings at Australian universities to demonstrate excellence on more traditional research esteem measures. These various pressures have resulted in the creation of management systems that hold these academic groupings and also individual academics accountable for their performances.

In terms of funding, the policy shift toward the performance-based allocation of research funds to universities has created considerable pressures on individual disciplines to conform to the common templates that are used to measure research productivity and excellence. It has also increased the pressure for academics to produce those publication outputs that are at the core of formal evaluations and rankings and to attract external research income, regardless of disciplinary affiliation. Finally, there are pressures resulting from the fact that competitive grant processes increasingly emphasise relevance and impact as important funding criteria. On the face of it, in relation to the disciplines we focus on in this book, it would appear as if these pressures would be more challenging to navigate by historians. This is due to the fact that the templates used for measuring research performances tend to be derived from those common in the sciences, and also because the physical sciences usually find it less difficult to attract external research income including public research grants and industry investment.

The picture is slightly different when it comes to teaching activities. Here, the way governmental funding operates—allocating funding as per enrolled domestic students—puts cost-intensive disciplines such as physics that attract only a comparatively small number of students due to their perceived difficulty at a distinct disadvantage (see for a further discussion of the problem of using input-based funding measures for disciplines such as physics Geuna and Martin 2003). Adding to this, physics also does not attract a large number of fee-paying international students; and the same applies to history. The running of physics departments at the Australian university thus usually has to be cross-subsidised through other faculties such as commerce that bring in more teaching revenue. While this practice may continue to be tolerated in the established research universities where there is a strong emphasis on rankings and prestige, this may be less so in other universities that focus less on their research and where resources are scarcer, and where physics as a discipline is at some risk as a result.

We have outlined in this chapter how changes in policy, governance and institutional management structurally and materially impact on the disciplines of history and physics at Australian universities. The important question remains however of

precisely how these changes and the associated challenges and pressures are seen and negotiated by the academics on the ground. We return to this question in our later discussion (particularly in Chap. 11).

References

Allen Consulting Group. (2010). *Employer demand for researchers in Australia (final report)*. Canberra, ACT: Department of Innovation, Industry, Science and Research.

Australian Research Council. (2012). *ERA indicator principles*. Retrieved from http://archive.arc.gov.au/archive_files/ERA/2012/Key%20Documents/ERA_2012_Indicator_Principles.docx

Bammer, G. (2012). *Strengthening interdisciplinary research: What it is, what it does, how it does it and how it is funded*. Melbourne: Australian Council of Learned Academies. Retrieved from http://www.acola.org.au/PDF/Strengthening%20Interdisciplinary%20Research.pdf

Beerkens, M. (2013). Facts and fads in academic research management: The effect of management practices on research productivity in Australia. *Research Policy, 42*(9), 1679–1693.

Bleiklie, I., & Michelsen, S. (2012). Comparing HE policies in Europe. *Higher Education, 65*(1), 113–133.

Bradley, D. (2008). *Review of Australian higher education: Final report*. Canberra, ACT: Commonwealth of Australia.

Butler, L. (2003). Modifying publication practices in response to funding formulas. *Research Evaluation, 21*(1), 39–46.

Christensen, T. (2011). University governance reforms: Potential problems of more autonomy? *Higher Education, 62*(4), 503–517.

Croucher, G., Marginson, S., Norton, A., & Wells, J. (2013). *The Dawkins revolution: 25 years on*. Carlton, VIC: Melbourne University Press.

Croucher, G., & Woelert, P. (2016). Institutional isomorphism and the creation of the unified national system of higher education in Australia: An empirical analysis. *Higher Education, 71*(4), 439–453.

Cutherbert, C., & Molla, T. (2014). PhD crisis discourse: A critical approach to the framing of the problem and some Australian 'solutions'. *Higher Education, 69*(1), 33–53.

Dawkins, J. (1988). *Higher education: A policy statement*. Canberra, ACT: Commonwealth of Australia.

De Boer, H., Enders, J., & Schimank, U. (2007). On the way towards new public management? The governance of university systems in England, the Netherlands, Austria, and Germany. In D. Jansen (Ed.), *New forms of governance in research organizations* (pp. 137–152). Berlin: Springer.

Department of Education. (2014). *Finance 2013: financial reports of higher education providers*. Canberra, ACT: Commonwealth of Australia. Retrieved from http://docs.education.gov.au/system/files/doc/other/finance_2013_1.pdf

DIISR (Department of Innovation, Industry, Science and Research). (2011a). *Defining quality for research training in Australia: A consultation paper*. Canberra, ACT: Commonwealth of Australia.

DIISR (Department of Innovation, Industry, Science and Research). (2011b). *Research skills for an innovative future: A research workforce strategy to cover the decade to 2020 and beyond*. Canberra, ACT: Commonwealth of Australia.

Enders, J., De Boer, H., & Weyer, E. (2013). Regulatory autonomy and performance: The reform of higher education re-visited. *Higher Education, 65*(1), 5–23.

Ferlie, E., Ashburner, L., Fitzgerald, L., & Pettigrew, A. (1996). *The new public management in action*. Oxford: Oxford University Press.

Forsyth, H. (2014). *A history of the modern Australian university*. Sydney: NewSouth Publishing.

Geuna, A., & Martin, B. R. (2003). University research evaluation and funding: An international comparison. *Minerva, 41*(4), 277–304.

Gläser, J., Lange, S., Laudel, G., & Schimank, U. (2010). The limits of universality: How field-specific epistemic conditions affect authority relations and their consequences. In R. Whitley, J. Gläser, & L. Engwall (Eds.), *Changing authority relationships in the sciences and their consequences for intellectual innovation* (pp. 219–324). Oxford: Oxford University Press.

Gläser, J., & Laudel, G. (2007). Evaluation without evaluators: The impact of funding formulae on Australian university research. In R. Whitley & J. Gläser (Eds.), *The changing governance of the sciences: The advent of research evaluation systems* (Vol. 384, pp. 127–151). Dordrecht: Springer.

Gumport, P. (2000). Academic restructuring: Organizational change and institutional imperatives. *Higher Education, 39*(1), 67–91.

Henkel, M. (2005). Academic identity and autonomy in a changing policy environment. *Higher Education, 49*(1–2), 155–176.

Hicks, D. (2012). Performance-based university research funding systems. *Research Policy, 41*(2), 251–261.

Hood, C., & Peters, G. (2004). The middle aging of new public management: Into the age of paradox? *Journal of Public Administration Research and Theory, 14*(3), 267–282.

Huisman, J., & Currie, J. (2004). Accountability in higher education: Bridge over troubled water? *Higher Education, 48*(4), 529–551.

Kemp, D. (1999). *Knowledge and innovation: A policy statement on research and research training*. Canberra, ACT: Commonwealth of Australia.

Krücken, G. (2014). Higher education reforms and unintended consequences: A research agenda. *Studies in Higher Education, 39*(8), 1439–1450.

Lake, M. (2011). *Submission to the TEQSA discussion paper, June 2011, 'Developing a framework for teaching and learning standards in Australian higher education and the role of TEQSA'*. Australian Historical Association. Retrieved from http://www.theaha.org.au/wp-content/uploads/2015/06/TEQSA_Discussion_Paper-submission.pdf

Larkins, F. P. (2011). *Australian higher education research policies and performance: 1987–2010*. Carlton, VIC: Melbourne University Press.

Larkins, F. P., & Croucher, G. (2013). Research. In G. Croucher, S. Marginson, A. Norton, & J. Wells (Eds.), *The Dawkins revolution: 25 years On* (pp. 248–264). Carlton: Melbourne University Press.

Lewis, J. (2013). *Academic governance: Disciplines and policy*. New York: Routledge.

Lorenz, C. (2012). If you're so smart, why are you under surveillance? Universities, neoliberalism, and new public management. *Critical Inquiry, 38*(3), 599–629.

Marginson, S. (1997). Steering from a distance: Power relations in Australian higher education. *Higher Education, 34*(1), 63–80.

Marginson, S., & Considine, M. (2000). *The enterprise university: Power, governance and reinvention in Australia*. Cambridge: Cambridge University Press.

Meek, V. L. (1991). The transformation of Australian higher education from binary to unitary system. *Higher Education, 21*(4), 461–494.

Neumann, R. (2009). Policy driving change in doctoral education: An Australian case study. In D. Boud & A. Lee (Eds.), *Changing practices of doctoral education* (pp. 211–224). London: Routledge.

Norton, A., & Cherastidtham, I. (2014). *Mapping Australian higher education, 2014–15.* Melbourne: Grattan Institute. Retrieved from http://grattan.edu.au/wp-content/uploads/2014/10/816-mapping-higher-education-20142.pdf

Norton, A., Sonnemann, J., & Cherastidtham, I. (2013). *Taking university teaching seriously*. Melbourne: Grattan Institute. Retrieved from http://grattan.edu.au/report/taking-university-teaching-seriously/

O'Connor, K., & Yates, L. (2014). Disciplinary representation on institutional websites: Changing knowledge, changing power? *Journal of Educational Administration and History, 46*(1), 1–16.

Pollitt, C. (2013). The logics of performance management. *Evaluation, 19*(4), 346–363.
Pollitt, C., & Bouckaert, G. (2004). *Public management reform: A comparative analysis*. Oxford: Oxford University Press.
Power, M. (1997). *The audit society: Rituals of verification*. Oxford: Oxford University Press.
Romzek, B. (2000). Dynamics of public sector accountability in an era of reform. *International Review of Administrative Sciences, 66*(1), 21–44.
Shore, C. (2008). Audit culture and illiberal governance: Universities and the politics of accountability. *Anthropological Theory, 8*(3), 278–298.
Vidovich, L. (2012). 'Transforming Australia's higher education system': New accountability policies for a global era? In H. G. Schuetze, W. Bruneau, & G. Grosjean (Eds.), *University governance and reform: Policy, fads, and experience in international perspective* (pp. 241–255). Basingstoke: Palgrave Macmillan.
Vidovich, L., & Currie, J. (2011). Governance and trust in higher education. *Studies in Higher Education, 36*(1), 43–56.
Weingart, P. (2013). The loss of trust and how to regain it: Performance measures and entrepreneurial universities. In L. Engwall & P. Scott (Eds.), *Trust in universities* (pp. 83–95). London: Portland Press.
Weingart, P., & Maasen, S. (2007). Elite through rankings: The emergence of the enterprising university. In R. Whitley & J. Gläser (Eds.), *The changing governance of the sciences: The advent of research evaluation systems* (pp. 75–99). Dordrecht: Springer.
Whitley, R. (2008). Universities as strategic actors: Limitations and variations. In L. Engwall & D. Weaire (Eds.), *The university in the market* (pp. 23–37). London: Portland Press.
Whitley, R. (2011). Changing governance and authority relations in the public sciences. *Minerva, 49*(4), 359–385.
Woelert, P. (2015). The 'logic of escalation' in performance measurement: An analysis of the dynamics of a research evaluation system. *Policy and Society, 34*(1), 75–85.
Woelert, P., & Millar, V. (2013). The 'paradox of interdisciplinarity' in Australian research governance. *Higher Education, 66*(6), 755–767.
Woelert, P., & Yates, L. (2015). Too little and too much trust: Performance measurement in Australian higher education. *Critical Studies in Education, 56*(2), 175–189.

Chapter 5
Changing Agendas and the Governance of the School Curriculum

Schooling has different origins and purposes than higher education and historically has had quite different forms of governance and national variation. Yet over recent times many of the governance features of the changing world of universities discussed in the previous chapter are also observable in schools. These include an enhanced concern with the economic significance of this institution; the New Public Management moves to manage schools through indirect steering using templates of numerical evidence; the intensified pressure of a global comparative perspective on what schools are achieving; and the emergence of new bodies and mechanisms to manage schools and produce the new forms of quantified performance evidence drawn on in policy. As with universities, the past two decades have been experienced as a period of dramatic change in the environment in which schools operate.

At times the changes and reforms to universities and schools overlap or have a common source, as in the data-gathering activities of the OECD and their eager reception by national governments; or earlier in the 1980s Dawkins reforms in Australia intended to create a 'unified national system' of education. At times the mechanisms of management are related, but take different forms, as in the specific prominence of the standardised testing agenda for teaching in schools which has no direct parallels in the key performance data collected for universities. But there are also strong distinctive elements of the purposes of schools and their history in Australia that are not paralleled in higher education and that have been a particular focus of changing governance processes in Australia in the past decade.

Schooling is concerned with some things that lend themselves fairly well to the standardised measurement of development the economists value—intellectual and technical skills, literacy, numeracy and the like—objectives that feed the currency of standards and comparative benchmarking. But schooling also traditionally has another purpose seen as important to national interests and values: the

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acculturation and induction of future citizens. In this arena, curriculum content is seen as an object of consequence, not as the black box of the economists and testers.

In Australia, one of the most important developments of recent times has been the establishment of ACARA (the Australian Curriculum, Assessment and Reporting Authority) as a new type of national authority, with a brief to develop a framework for a first national (as compared with state-based) 'Australian Curriculum'. This represents a major intervention which we will discuss later in this chapter, both in process or governance terms and also in terms of the very visible public framing of the knowledge agenda for schools. This current concern with the substantive curriculum (that is, beyond the standards agenda) and the need to reform it is not peculiar to Australia (Yates and Grumet 2011). In relation to curriculum, 'globalisation' is not simply about a global commonality or uniformity. Rather national curriculum authorities and governments reform their history and civics curricula in particular to incorporate and respond to fears about migration, and to develop new forms of citizenship and national identity and integration in the face of the global.

In the governance of schooling in Australia federalism is also a distinctive issue. Historically the Commonwealth government has only those powers given in section 51 of the Constitution, and the management of schooling resides outside these, within the authority of state governments (leaving aside for now the story of the Catholic education system, and independent schools, which are an unusually large component of Australian schooling compared with most other countries). However state governments have limited taxing power, and since the mid-20th century, Commonwealth governments have used financial mechanisms to drive specific purpose spending in schools (Keating and Klatt 2013). At the same time, even in the past half-century when new mechanisms of inter-governmental co-operation between states were established, 'schooling, along with hospitals and police, appeared to be central to the states' self-definitions, and policy domains which they wished to jealously protect' (Lingard 2000). Disputes over these matters had undermined earlier attempts to produce a 'nationally consistent curriculum' in Australia in the 1990s (Marsh 1994; Yates et al. 2011). Later in this chapter we discuss further the new moves towards national mechanisms and a national curriculum over the past decade. The changing negotiations between states and the Commonwealth, between sectors, between professional organisations, parents and the public set up some of the drivers (or 'conditions of possibility') through which knowledge in the context of schools is developed.

In this chapter then we begin with the global or international movements, especially of testing and benchmarking, and the debates about these. We then examine the Australian context. In both cases we consider the new mechanisms and bodies that are being established and the kinds of impacts these have, as well as the substantive curriculum agendas that are relevant to our interest in the discipline based subjects of physics and history.

Education, Evidence-Based Policy Making and Globalised Agendas for Schooling

Across the world, a similar kind of rhetoric has come to dominate thinking around education and education policy. From the late 20th century, most nations began to take education very seriously as a core component of their national economic capacity. And they began to see both education and economic capacity in a particular way: as relative performance on globally comparative and competitive standards. Market choice and competition came to be seen as a good model for schools and universities, and assessment and rankings acquired high visibility as the authoritative way in which governments and the public assess what is being achieved by schools and individuals. As economic competition between countries has heightened, international comparisons via standardised testing programs has gained increasing prominence as an indicator of how well a nation's youth might compete in future global markets. The primary example of this has been the OECD's Programme for International Student Assessment (PISA) which involves three yearly assessment of a structured sample of school students in some 60 countries and produces from these a series of country rankings and comparisons in relative performance, both overall and by spread (for example whether the results indicate high or low equity in that country).

Countries around the world have been increasingly drawn into debates set against international standards or criteria (Karseth and Sivesind 2010; Lingard 2011); and schools are increasingly set in a rhetoric of globalisation and the global citizen (Rizvi and Lingard 2010). A new emphasis on 'policy borrowing' (Lingard 2010) has emerged, producing some convergence of particular policy ideas and practices. This new 'global policyspeak' (Ball 2008, 1) is playing a significant role in driving nations towards emphasising policies around school-based management, privatisation, parental choice, data-driven evidence-based practice and accountability. New programs of assessment, national and international, have been introduced, designed to produce quantitative evidence and comparisons of standards and quality and comparative achievement between schools and nations. These shifts have ushered in a new era of New Public Management governance, with schools increasingly subject to greater external scrutiny through ongoing performance measurement and benchmarking.

Although ostensibly focused on outcomes rather than curriculum, these shifts have nevertheless had significant curricular implications. As Karseth and Sivesind (2010, 109) argue, 'organisations like OECD advocate a new political technology where formalised curriculum-making is ignored or even contested in favour of assessment and accountability systems'. As part of the reframing of education within an economic agenda, there has been a growing emphasis on skills for the 21st century and the measurement of student competencies and learning

outcomes as an approach to structuring curriculum. The OECD's Definition and Selection for Competencies (DeSeCo) Project for example was set up to define the 'key competencies for personal social and economic wellbeing' in the 21st century, which it identified as 'interacting in socially heterogeneous groups; acting autonomously; and using tools interactively' (OECD 2005, 5). Similarly, the research project Assessment and Teaching of 21st Century Skills, which included researchers across four founder countries (Australia, US, Finland and Singapore) and was funded by Cisco, Intel and Microsoft, has sought to define 21st century skills and promote their assessment in classrooms across the world (Griffin et al. 2012). These global programs have had substantial influence and have been used as significant sources of evidence in many national curriculum policy discussions, including in Australia (Ball 2012). In place of approaching curriculum in terms of passing on the important knowledge of the past (or the present), such approaches reframe curricular debates in terms of 'backward-mapping' the changing world of the future, especially the skills and competencies seen to best prepare students for employment in an ever-changing world.

In the context of global education benchmarking, a number of countries have moved to develop a new national form of curriculum and learning standards, including countries with previously more diverse provision (e.g. Australia, but also the USA, England and Finland) (OECD 2004). The fate of these initiatives has varied—with the UK moving first towards a common national curriculum, then away from that; and with the USA move to have Common Core State Standards in certain curriculum areas but much resisted not just on its substance but as an inappropriate extension of federal powers over schooling. Nevertheless in many countries new forms of national testing and new forms of accountability have emerged in response to concerns about quality (Hopmann 2013; Priestley and Biesta 2013). In the USA, the *No Child Left Behind* Act ushered in an unprecedented focus on testing and accountability across the states, which was subsequently strengthened and further nationally aligned through the work of the Common Core State Standards and the Race to the Top program. And in Australia, national testing has been introduced in the form of the NAPLAN program (discussed further below).

These shifts, and particularly the emphasis constantly given to the OECD PISA assessments as the locus of education discussion, have been widely criticised within the education policy literature. In May 2014 some 100 educationists around the world signed an Open Letter to Dr Andreas Schleicher, Director of the OECD PISA program (Meyer and Zahedi 2014). This letter sums up discussions that had been widely aired elsewhere among national education associations and in the research literature and expresses concern about the impact of PISA on education systems around the world. It begins by noting the major impact PISA has had on national governments: 'As a result of PISA, countries are overhauling their education systems in the hopes of improving their rankings.' The letter goes on

to enumerate in some detail the impact of this program on the curriculum and the work of schools. In summary, it makes these points:

- That PISA has contributed to a marked escalation of reliance on quantitative measures as the key form of understanding what schooling is doing, and produces a narrowing of curriculum focus and pedagogic practices in doing so.
- Its prominence and three-year assessment cycle generates too much attention by politicians to short-term fixes to climb the rankings, rather than longer-term improvements in the underpinnings of teaching.
- As an organisation of economic development (and, unlike the UNESCO and UNICEF), OECD is not an organisation set up with a brief to improve education, and 'is naturally biased in favour of the economic role of public schools', but that is not the only role of public education.
- The PISA processes have embraced and escalated involvement of multi-national for-profit companies which have a financial interest and motives in the kinds of 'deficits' that are revealed, and the kinds of solutions that are offered.

A number of kinds of argument are rolled together here, and in broad terms the debates have strong echoes of the literature on the effects of 'new policy management' discussed in relation to universities in Chap. 4. They also echo some debates in the literature on the 'new production of knowledge' (discussed in Chap. 2) in their concerns that the economic context of the outputs to be produced now drives the framing agendas for curriculum.

An immense part of the schooling policy and curriculum literature in the past decade has been concerned with the effect of making programs of testing the driving agenda of the practices of schools, with curriculum and pedagogy practices backward mapped from that. Those supportive of the testing escalation argue this produces a transparency, benchmarking and push towards higher standards that prevents schools and teachers hiding ineffectiveness in what they do (Muller and Hoadley 2014; OECD 2012; and see discussion in Yates 2013). Critics of the increasing prominence of the testing core (see for example Ball 2006; Hopmann 2013; Hursh 2008; Lingard 2010; Nichols and Berliner 2007; Polesel et al. 2012; Stobart 2008; Yates and Grumet 2011) see a 'tail wagging the dog' problem here—that testing or assessment stops serving the interest of supporting teaching, giving feedback and information to teachers, students and parents; and instead teaching becomes almost entirely directed to supporting the testing, 'teaching to the test', with potential short-termism and narrowing as a result.

One concern of the critical literature is about what happens to different parts of the curriculum when some are included in 'high stakes' testing and others are not (for example an over-emphasis on the basics, an under-emphasis on the arts). A second, in relation to subjects that are tested, is that 'teaching to the test' produces shallower learning with short-term results at the expense of longer-term engagement with the subject. Both concerns are potential issues for the two school subjects we follow in this study, physics and history. A third concern is that in practice the teaching to the test narrows the curriculum more heavily in disadvantaged and

more diverse schools, and that it produces a boring experience and dis-engagement for those students who are already most in danger of doing poorly.

Nevertheless testing data has remained popular with the media and, apparently, with the broad electorate (politicians of both sides proudly take credit for driving it). At a minimum however, the arguments both in favour and critical of these programs of testing raise empirical questions about what is actually happening as a result of them: how much of the space and emphasis in schools such testing takes up, and how well the testing is in fact capturing important elements of intended learning. In later chapters we hear some perspectives on this matter from those teachers charged with teaching history and physics.

Testing, and even high stakes testing, has long been part of schooling systems—in Australia in the 19th century payment of teachers by results was common; in the UK up to the 1970s the 11 plus examination was a major decider of schooling fates of individual students. But the research literature suggests something new is at work: that the purpose of these tests now is not just about assessing what is being learned or not learned, is not just about the internal workings of education and schools, but is about external accountability and demonstration to the public of claims by politicians to be improving the education system (Nichols and Berliner 2007; Hopmann 2013; Yates 2013). What is at issue is not simply the testing and the outcomes of making public particular scores for particular students, but the presence of a different lens through which the public understanding of schools and their mission becomes concentrated on numerical scores and relative rankings.

A further part of this intensely competitive focus on a limited range of numerical scores noted in some of the literature, particularly in Europe (for example Ertl 2006; Grek 2009; Karseth and Sivesind 2010), has been the issue of shifting from national judgments and configuration of the school curriculum to international ones. Here the authority of the OECD as the source of the process, and its glossy and effective forms of communicating its reports, both play a part (see Sellar and Lingard 2013). For example, Germany's education system had been much admired for some time in terms of the particular form and the quality of its vocational education both at school and post-school level. But the presentation of PISA data, using its own standardised template, reported that Germany ranked poorly on education inequality patterns, and this led to major public debates and some changes in that country (see Martens and Niemann 2013; Wiseman 2010). The results of each PISA cycle are presented in graphics and tables that lend themselves to ready governmental and journalistic scrutiny for negative stories. The use of multiple 'where your country ranks' lists has a similar effect, even though the differences between being listed as no. 12 compared with no. 17, or indeed 'falling' from no. 12 to no. 17 between two PISA rounds, may be so tiny as to be insignificant or statistically unreliable.

High stakes national testing has been shown to have reductive and narrowing curricular effects and to be detrimental to teacher professional identity in the

long term (Stobart 2008). Ball (2006) argues that high stakes testing and a culture of performativity in England frames teachers as technicians of centralised and standardised curriculum, impeding their ability to use authentic pedagogies and assessment practices. Hursh (2008) has similarly argued that related practices in the USA have lowered the quality of learning and led to a narrowing of focus, particularly in school communities serving disadvantaged students. The focus on assessment and scores as the proxies of how well schools are educating can be seen to produce a drive to focus on a particular type of learning for the examination. The numbers become a proxy for the thing itself (the education or learning that they ostensibly measure). The 21st century skills promoted by the OECD and other global initiatives tend to become those that are easily assessable on a large scale and often, those that can be most readily taken up by corporate interests (Ball 2012; Gorur 2011).

At the same time as the testing agendas and benchmarks have become increasingly important, another set of more nationally specific concerns have arisen, this time directed at the acculturation role of education. In the face of changing borders and population flows, global economic threats, widening inequalities of income and the like, many countries have felt the need to revisit the story they tell their next generation through the compulsory schooling years, to review and take a stronger direction of the history curriculum, or to re-emphasise a civics or 'values' curriculum, to set up more particularly how they want young people to see their allegiance to the nation as well as their opportunities in the world (see Yates and Grumet 2011 for a range of examples). Despite the significance of global policy processes and influences, government curriculum anxieties, intents and actions continue to relate strongly to concerns about the nation. The curriculum, originally a national artefact, is now firmly positioned in a world of much more porous borders, and aiming to produce global citizens who can flourish in that world. But it also aims to produce some degree of patriotism and identification with the nation, both for purposes of social integration, and as a further support to the national economic agenda.

Changing Emphases in Curriculum Development in Australia

Structures, Processes, Politics

In Australia, as we noted at the beginning of this chapter, curriculum has been historically developed by state authorities rather than at a national level. Since the 1960s initiative to fund science blocks and libraries under Prime Minister Robert

Menzies, Commonwealth (national) policies and authorities have aimed to influence particular limited aspects of curriculum using special funding programs tied to particular forms of compliance, but the broad curriculum frameworks, assessments and guides were developed at state level. Moreover, each of the six states and two territories has tended to develop different approaches to schooling and curriculum, influenced by its particular histories, cultures, geographies and demographies, though with considerable overlap (Yates et al. 2011). States and territories differed across Australia for much of their existence with respect to school starting ages, the structure of the primary and secondary years, pre-school education and senior secondary awards (Keating et al. 2013). States have differed too over the degree to which curriculum was specified centrally or devolved to individual schools. Adding to this complexity, the schooling system is also divided into three sectors (state, Catholic and Independent), and a growing and significant percentage of students (35 % in 2012) are educated in non-government schools.

Since the 1980s, prior to recent changes in Commonwealth-State relationships, there has also been a change in the way curriculum has been governed and managed, with it becoming more directly and visibly part of the agenda of government and Education Ministers rather than education departments within the public service or simply devolved to schools. Fensham (2012) for example has analysed changes in the science curriculum since the 1970s as a change from a contest between science educators and academic scientists, to a contest increasingly controlled by government bureaucrats. From the 1980s on, state governments in Australia developed new authorities (Boards of Studies and the like) to govern education which were more directly under ministerial control (Yates et al. 2011).

The changing political significance of education is also seen in other ways. In the 1990s, an aspiring Prime Minister, John Howard, had refused to take on the portfolio of Education as too low ranking (Errington and van Onselen 2007); but in 2007 another aspiring Deputy Prime Minister, Julia Gillard, chose the Education portfolio rather than the traditional one of Treasury as her platform and stepping stone to the leadership. The prominence given to the 'education revolution' as the centrepiece of Labor's 2007 election policy was 'based on the premise of education's capacity to deliver human capital' (Keating and Klatt 2013, 419).

In the case of curriculum, such shifts change who are significant voices in curriculum formation (the 'community', the media, voters rather than just teachers, students and parents) and change the material forms curriculum framing and justifications now take. For example, one problem with a curriculum that is being developed as an arm of politicians and their platforms is the tendency to overload the promises. The glossy brochures designed for both a general reader and education professionals, often come to grief in this ambiguity of purpose. The documents are now not just speaking to teachers but are part of the political accountability agenda, open to criticisms from all sides on which elements of history are getting too much or too little attention; whether all the science topics have been covered; whether there is too much or too little inclusion of social implications of science etc. Including too much jargon or technical specifics or expert appeal incites ridicule from the media (Snyder 2008). But the imperative to

demonstrate to the public the utopian visions and the multiple forms of accounting that the governments will achieve by the new reforms (the highly employable flexible life-long learner of the 21st century with teachers and students multiply tracked and measured in fine detail to demonstrate progress) can impose too great a burden on schools and teachers as to how to bring such multiple and often utopian agendas together.

ACARA and the Shift Towards a National Curriculum

The past thirty years also produced a decisive shift towards stronger national curriculum consistency across the country. In part this is a thread of culturalist thinking about the role of schools and the desirability of a substantive national framework for curriculum evident since at least the late 1970s (via Malcolm Skilbeck and the Curriculum Development Centre), and in part it is associated with philosophies of efficiency and standardisation associated with John Dawkins and others as discussed earlier. We say more about the particular developments of both kinds shortly, but on the issue of efficiency and politics and changing forms of federalism, Keating and Klatt (2013, 416) conclude,

> The past three decades have seen the emergence of a plethora of national educational bodies that have amongst their stated purposes, the achievement of more consistency and better coordination, including that between the levels of government, in education. Yet, on the whole, the state systems are largely preoccupied with running their own systems and the nongovernment schools have sought, very successfully, to maximise funding and maintain their autonomy.

In the early 1980s, the Curriculum Development Centre led by Malcolm Skilbeck published a report proposing 'A Core Cultural Curriculum for Australian Schools' (Curriculum Development Centre 1980), and in the late 1980s and early 1990s the then Minister for Education, John Dawkins, led the development of a set of common 'Curriculum Statements and Profiles' for key learning areas. Although the states for political reasons ultimately failed to endorse the new curriculum framework documents (Marsh 1994), state authorities continued to work with each other and the Commonwealth through bodies comprising ministerial representatives (currently under the auspices of the Education Council) and common agreements and declarations of goals for Australian school students were established. The Commonwealth government also continued to influence curriculum through the use of specific-purpose funding grants, and through the establishment of inquiries and funding bodies with particular agendas (in relation to boys education or citizenship education for example). The first 'national' policy for schooling in Australia was the *National Policy for the Education of Girls in Australian Schools* (Schools Commission 1987) (see Yates 1993).

Following proposals for a national history curriculum by the Howard Liberal/National Coalition government in the early 2000s, the Rudd/Gillard Labor government proposed the establishment of a national curriculum as part of its 'education

revolution' election platform. Shortly after taking office in 2007 it established a National Curriculum Board (NCB) with a brief to develop curriculum in four subjects: English, maths, science and history. In May 2009, the NCB became a new statutory body, the Australian Curriculum Assessment and Reporting Authority (ACARA). At this time, following lobbying from professional and teacher association groups, the remit of the authority was expanded to include assessment and reporting responsibilities and the curriculum broadened to include a raft of other subject areas. A second phase of development was identified, comprising subject frameworks for geography, languages and the arts, followed by a third phase of development for technologies, economics and business, civics and citizenship and health and physical education. Two other dimensions were also added to the curriculum at this time: seven 'general capabilities' (literacy, numeracy, ICT, critical and creative thinking, social and personal capability, ethical behaviour and intercultural understanding) and three 'cross-curriculum priorities' (Aboriginal and Torres Strait Islander histories and cultures; Asia and Australia's engagement with Asia; and Sustainability).

These additional dimensions were designed to be embedded within the subject-based curricular program, and the three dimensional structure can be seen as an attempt to incorporate both global concerns about the importance of 21st century skills and cross-disciplinary issues alongside a traditional belief in the importance of disciplinary teaching foundations. In an interview published in the Huffington Post in 2011, Professor Barry McGaw, then Chair of ACARA, argued that through its three dimensions, the curriculum structure,

> …lets us have it all ways. We can embrace general capabilities that are particularly important in the 21st Century without abandoning well established discipline based ways of knowing. We can also provide protection to current issues, such as those captured in our cross-curriculum priorities, that we believe should be an important part of the world view offered to young Australians.
>
> (Rubin 2011)

Through its development of the curriculum, ACARA has set in train a process and templates that have attempted to refresh a 'holistic' perspective on what a school subject such as history or physics means over time, how it is developed, and what is emphasised in it. The processes involved are set out in some detail on the ACARA website (www.acara.edu.au). They include various iterations of consultation, approval by state and tertiary ministers, trialling, implementation, monitoring and evaluation.

ACARA represents a new approach to curriculum development in Australia and is changing the way curriculum is developed and managed away from the former jurisdiction of state curriculum and qualification bodies, though state and sector authorities have practical authority over the timing and form and extent of implementation, which is not uniform. Both the states, Commonwealth and Australia's three school sectors are represented within the ACARA board and ACARA is jointly owned and funded by the federal government and the six state and two territory governments. Savage and O'Connor (2015) have argued that the

governmental structure of ACARA has played an important role in its success to date in negotiating with state and territory curriculum agencies and other relevant policy stakeholders (particularly in comparison with the USA's development of the Common Core State Standards whose governing body lacks the same 'buy-in' from state representatives).

While both of Australia's major political parties have supported shifts towards a stronger national approach to curriculum, they differ in some specifics as to what should be emphasised (a potential problem in that the time frame of a curriculum development and implementation is much longer than a term of office of a government). They also differ to some extent in their preferred approach, with the Labor party tending towards a 'big government' approach to curriculum management, compared with Liberal scepticism of this. While much of the initial work on the Australian Curriculum was developed under two terms of Labor government, the incoming Liberal Coalition government under Prime Minister Tony Abbott set up a review of this (discussed further below), with appointees and terms of reference that were broadly interpreted as partisan and hostile to the work undertaken to that point. In turn, the review, by Donnelly and Wiltshire (2014), has criticised ACARA's governance structure for its lack of independence from education ministers and education departments, arguing this has contributed to a curriculum structured around a compromise of differing state interests. They have recommended ACARA's governance be reformed to allow it to operate at 'arm's length from the education ministers and their departments'. At the time of writing some recommendations from the review on particular curriculum issues have been incorporated by ACARA, but as yet, no significant changes to the formal constitution of this 'curriculum, assessment and reporting' body have been made.

The ACARA approach to curriculum development comprised a staged process for each subject including commissioned framing and shaping papers prior to the development of frameworks, and widespread consultation with professional groups and with the public at large for each stage. The framing curriculum documents set out key focus and elements for each year of schooling, but leave scope for states and schools to make some decisions about detailed elements of what will be taught. The documents were developed by subject panels which included both tertiary and school representatives from each discipline area, with some oversight and direction from within ACARA. Each subject area was required to identify content and achievement standards expected at each year level. In its initial formulation all curriculum documents accorded to the same template style across subjects and year levels, despite the different forms of development expected across subjects, and the different ways primary and secondary schools had traditionally approached curriculum (with integrated or thematic approaches more common in primary and within-subject development more the focus in secondary.).

ACARA was also tasked with responsibility for the national assessment program for literacy and numeracy (NAPLAN); and oversees the *My School* website. NAPLAN was introduced across the country in 2008 and tests students in a select number of year levels (years 3, 5, 7 and 9) in reading, writing, language conventions (spelling, grammar etc.) and numeracy. The *My School* website (http://www.

myschool.edu.au/) reports on the NAPLAN results of individual schools along with a range of other data, including their resources, demographic make-up and academic results, and enabling comparison with 'like' schools and all schools on that data. The website has been popular with the electorate, and, like PISA charts, has become a popular reference tool for schools and those writing about schools and has heightened interest in cross-school comparisons. The tests are conducted in all schools in the country, both government and non-government, and every school has its performance recorded on the website. The league tables, under the logic of market choice, are intended to drive parental decisions about school selection. School performance against like schools is represented with colour coding which Lingard and Sellar (2013) suggest has the result of reducing 'a complex technical process for determining levels of achievement, full of ambivalent analytical decisions…in terms of "green" for good and "red" for bad.'

With the change of government from a Labor government to a Liberal/National Coalition government in 2013, Prime Minister Tony Abbott instigated a review of the curriculum, citing bias in the history curriculum (too little attention to Australian achievements and Judeo-Christian traditions for example) as a particular focus. The review, chaired by Kevin Donnelly, a prominent critic of current teaching in history and English, and Ken Wiltshire, a proponent of market-based economic thinking, criticised the Australian Curriculum and the work of ACARA in relation to: the lack of an overarching curriculum framework and statement of purpose guiding the curriculum development process; overcrowding of content, particularly in the primary years and as a result of the curriculum's three dimensional structure; and a perceived lack of balance in relation to the history and civics curricula and in the promotion of inquiry-based and student-centred pedagogies. As part of thirty recommendations, the review proposed the development of a comprehensive curriculum framework including notional time allocation for each subject, the reduction of specified curriculum content to a narrow core, and a reconfiguration of the three strand structure to subsume the majority of the general capabilities (all but literacy, numeracy and ICT) and the three cross-curriculum priorities within the mandatory content of the curriculum where educationally relevant. It also called for a stronger emphasis on morals, values and spirituality and a stronger recognition of the contribution of Western civilisation, Australia's Judeo-Christian heritage, economic development and the British system of government (Donnelly and Wiltshire 2014).

Following the review, ACARA issued a statement advising it was working on identifying areas for content reduction in the primary school years, refining and reducing the number of content descriptions and achievement standards across the curriculum, and redesigning humanities and social sciences into one learning area curriculum for the primary years (ACARA 2015). Revisions to the curriculum across the eight learning areas were endorsed by the Education Council in September 2015. According to a statement by the Minister for Education, the changes 'resolve the overcrowding in the primary curriculum, boost the teaching of phonics and strengthen references to Western influences in Australia's history' (Pyne 2015).

The primary issue raised by the review in relation to overcrowding has met with widespread support politically and within the education community. In our interviews (discussed further in subsequent chapters) there was widespread acknowledgement of this problem, with most teachers less concerned about the form of the curriculum than the 'too much' issue (and our research on this issue was drawn on and cited in the review report). As the review indicated, in part this problem has arisen from the highly consultative approach ACARA has taken in their curriculum development. In a democracy there will always be a wide range of views about what should be included within curriculum texts, and the public circulation of documents and the search for a reasonable degree of consensus around the country has tended to lead to things being added (especially for history) rather than taken away.

However, as indicated earlier, a second issue has to do with the entanglement of curriculum within the political agenda and the requirement for it to be a politically positive demonstration of what the government of the day is achieving. Despite concerns raised in the review that the Australian Curriculum is not 'parent-friendly', its multi-dimensional curriculum structure can be seen as an attempt to manage diverse stakeholders, to speak to multiple views in the community (including parents) about what needs to be emphasised within a modern day curriculum (disciplinary knowledge, 21st century skills etc.). Curriculum is now part of a very open public and political discussion in Australia and this produces the overcrowding which has a detrimental effect on what the curriculum is likely to achieve in practice. The review's recommendations for increasing parent input into the curriculum discussion is more likely to contribute to the problem of overloading than it is to rectify it. Moreover, the issue of what should and should not be included within a curriculum, and what of that should be mandated or optional or subject to school-based interpretation is an ongoing question and not easily resolved as our later chapters on history and physics will show. Even within a review led by two experts cherry-picked by one political party, no one option was able to be put forward (each reviewer proposed a different preferred curriculum structure).

Conclusion

This chapter has provided an overview of the school context sitting behind our study, including the rise of a neoliberal and instrumental approach to schooling and education management and the development of a new national curriculum. In the case of school curriculum, a number of governance developments are in play. First there is a heightening of focus on testing and quantified forms of comparison, internationally, nationally, and by 'like school' in Australia. Secondly there is some broad take-up of New Public Management orientations to improving school performance via competition and quantified and public data. Thirdly, in Australia there is a move to greater national uniformity via the setting up of a new authority responsible for curriculum, assessment and reporting. This authority changes

previous federal arrangements by including both state and federal ministerial representatives, and independent, Catholic as well as state schooling representatives in its governing body. The processes of curriculum development in Australia now take a multi-phased form with multiple consultations, but with ultimate approval decided by ministerial representatives, and actual practical implementation still located within state structures and agendas.

Our interviews were conducted during the development of the Australian Curriculum shaping and framing curriculum documents in science/physics and history, and we asked teachers about where they saw the curriculum in their discipline heading, including any comments they might want to make about the new Australian Curriculum. However, in our project we were not aiming to provide an assessment of the new frameworks, but rather to explore the range of issues teachers are grappling with at the present time: in terms of what is important in and for their subject, and in terms of how the conditions of their work are impacting on this. This chapter has drawn attention to some of the background context for this work, including the utilitarian rhetoric dominating curriculum discussions and developments across the political divide, and the tendency of all sides to party-politicise curriculum discussions. The chapters in the following section of this book will look at our interview data and how teachers themselves saw their subjects and the conditions of their curriculum work today.

References

ACARA. (2015). *Improving the Australian curriculum*. Retrieved from http://www.acara.edu.au/verve/_resources/20150508_IMPROVING_AUST_CUR_v_2_2-1.pdf

Ball, S. J. (2006). *Education policy and social class*. London: Routledge.

Ball, S. J. (2008). *The education debate*. Bristol: Policy Press.

Ball, S. J. (2012). *Global education inc.: New policy networks and the neoliberal imaginary.* New York: Routledge.

Curriculum Development Centre. (1980). *A core curriculum for Australian Schools: What it is and why it is needed*. Canberra, ACT: Curriculum Development Centre.

Donnelly, K., & Wiltshire, K. (2014). *Review of the Australian curriculum final report.* Canberra, ACT: Australian Government Department of Education. Retrieved from https://docs.education.gov.au/documents/review-australian-curriculum-final-report

Errington, W., & Van Onselen, P. (2007). *John Winston Howard: The definitive biography*. Carlton, Vic.: Melbourne University Press.

Ertl, H. (2006). Educational standards and the changing discourse on education: The reception and consequences of the PISA study in Germany. *Oxford Review of Education, 32*(5), 619–634.

Fensham, P. J. (2012). The science curriculum; the decline of expertise and the rise of bureaucratise. *Journal of Curriculum Studies, 45*(2), 152–168.

Grek, S. (2009). Governing by numbers: The PISA 'effect' in Europe. *Journal of Education Policy, 24*(1), 23–37.

Griffin, P., McGaw, B., & Care, E. (Eds.). (2012). *Assessment and teaching of 21st century skills*. Dordrecht: Springer.

Gorur, R. (2011). ANT on the PISA Trail: Following the statistical pursuit of certainty. *Educational Philosophy and Theory, 43*(s1), 76–93.

Hopmann, S. T. (2013). The end of schooling as we know it? *Journal of Curriculum Studies, 45*(1), 1–3.
Hursh, D. (2008). *High-stakes testing and the decline of teaching and learning*. New York: Rowman & Littlefield.
Karseth, B., & Sivesind, K. (2010). Conceptualizing curriculum knowledge—within and beyond the national. *European Journal of Education, 45*(1), 107–124.
Keating, J., & Klatt, M. (2013). The Australian concurrent federalism and its implications for the Gonski Review. *Journal of Education Policy, 28*(4), 411–426.
Keating, J., Savage, G. C., & Polesel, J. (2013). Letting schools off the hook? Exploring the role of Australian secondary schools in the COAG Year 12 attainment agenda. *Journal of Eduction Policy, 28*(2), 268–286.
Lingard, B. (2000). Federalism in schooling since the Karmel Report (1973), Schools in Australia: From modernist hope to postmodernist performativity. *Australian Educational Researcher, 27*(2), 25–61.
Lingard, B. (2010). Policy borrowing, policy learning: Testing times in Australian schooling. *Critical Studies in Education, 51*(2), 129–147.
Lingard, B. (2011). Policy as numbers: A/counting for educational research. *Australian Education Researcher, 38*(4), 355–382.
Lingard, B., & Sellar, S. (2013). 'Catalyst data': Perverse systemic effects of audit and accountability in Australian schooling. *Journal of Education Policy, 28*(5), 634–656.
Marsh, C. (1994). *Producing a national curriculum: Plans and paranoia*. Sydney: Allen & Unwin.
Martens, K., & Niemann, D. (2013). When do numbers count? The differential impact of the PISA rating and ranking on education policy in Germany and the US. *German Politics, 22*(3), 314–332.
Meyer, H.-D., & Zahedi, K. (2014, 5 May). An open letter: To Andreas Schleicher, OECD, Paris. *Global Policy Journal*. Retrieved from http://www.globalpolicyjournal.com/blog/05/05/2014/open-letter-andreas-schleicher-oecd-paris
Muller, J. & Hoadley, U. (2014). Testing times: Investigating the epistemic potential of systemic tests. Paper presented to the European Conference on Educational Research 2014, University of Porto, 1–5 September.
Nichols, S. L., & Berliner, D. C. (Eds.). (2007). *How high stakes testing is corrupting America's schools*. Cambridge, MA: Harvard University Press.
OECD. (2004). *What makes school systems perform? Seeing school systems through the prism of PISA*. Paris: Organisation for Economic Co-operation and Development (OECD). Retrieved from http://www.oecd.org/education/school/programmeforinternationalstudentassessment-pisa/33858946.pdf
OECD. (2005). *Definition and selection of competencies executive summary.* Paris: Organisation for Economic Cooperation and Development (OECD). Retrieved from http://www.oecd.org/pisa/35070367.pdf
OECD. (2012). *Delivering education transparency in Australia: national reporting through My School.* Paris: Organisation for Economic Cooperation and Development (OECD). Retrieved from http://www.oecd.org/australia/Strong%20Performers%20and%20Successful%20Reformers%20in%20Education%20-%20Delivering%20School%20Transparency%20in%20Australia.pdf
Polesel, J., Dulfer, N., & Turnbull, M. (2012). *The experience of education: the impacts of high stakes testing on school students and their families.* Sydney: Whitlam Institute Report, University of Western Sydney. Retrieved from https://www.whitlam.org/__data/assets/pdf_file/0010/409735/High_Stakes_Testing_An_Educators_Perspective.pdf
Priestley, M., & Biesta, G. (Eds.). (2013). *Reinventing the curriculum: New trends in curriculum policy and practice*. London: Bloomsbury.
Pyne, C. (2015). *A new national curriculum from 2016. Media release. 18 September.* Retrieved from https://ministers.education.gov.au/pyne/new-national-curriculum-2016
Rizvi, F., & Lingard, B. (2010). *Globalizing education policy*. London: Routledge.

Rubin, C. M. (2011, 15 June). The global search for education: Australia on the move. *The Huffington Post*. Retrieved from http://www.huffingtonpost.com/c-m-rubin/the-global-search-for-edu_1_b_875633.html?ir=Australia

Savage, G. C., & O'Connor, K. (2015). National agendas in global times: Curriculum reforms in Australia and the USA since the 1980s. *Journal of Education Policy, 30*(5), 609–630.

Schools Commission. (1987). *A national policy for the education of girls in Australian schools*. Canberra, ACT: Schools Commission.

Sellar, S., & Lingard, B. (2013). The OECD and global governance in education. *Journal of Education Policy, 28*(5), 710–725.

Snyder, I. (2008). *The literacy wars: Why teaching children to read and write is a battleground in Australia*. Crows Nest, NSW: Allen and Unwin.

Stobart, G. (2008). *Testing times: The uses and abuses of assessment*. London: Routledge.

Wiseman, A. W. (Ed.). (2010). *The impact of international achievement studies on national education policymaking*. Emerald: Bingley.

Yates, L. (1993). What happens when feminism is an agenda of the state? Feminist theory and the case of education policy in Australia. *Discourse, 14*(1), 17–29.

Yates, L. (2013). Revisiting curriculum, the numbers game and the inequality problem. *Journal of Curriculum Studies, 45*(1), 39–51.

Yates, L., Collins, C., & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: state cultures and the big issues*. Carlton, Vic.: Melbourne University Press.

Yates, L., & Grumet, M. (Eds.). (2011). *Curriculum in today's world: Configuring knowledge, identities, work and politics*. New York: Routledge.

Part III
Schools

Chapter 6
Australian 'History Wars': The Contested Purpose of History in the Curriculum

As discussed in Chap. 3, prior to the recent development of a national framework for history as part of the Australian Curriculum, there was considerable variation in Australia in how much history students were taught, the extent to which history was taught as a distinct school subject, what topics were emphasised, what status it was given in the school curriculum. In the decade prior to the moves to develop history as part of the Australian curriculum, there was also considerable public debate about school history and what it should do, both in relation to its content, and its relevance to the role of schools today. In this chapter we look in detail at what history teachers say about what matters in history as a school subject. These teacher views are considered in the context of the Australian political and media debates about history, and the framing work on the national Australian history curriculum, and the questions the various positions imply in relation to the purpose of the history subject in the school curriculum.

Why Does History Matter or What Matters About History?

As highlighted in Chap. 2, from the mid 20th century we have seen many different lenses on the purpose of curriculum: as giving access to important forms of knowledge, as means of developing the person in particular ways, or (from a critical perspective) as means of reproducing social divisions and hierarchies. More recently again attention has also been given to the world of the future as the focus of curriculum purposes: '21st century skills', capabilities and the like. Much of this work considers curriculum in relation to its future vocational utility and its efficacy in producing the kinds of workers needed to take on the new jobs of the future.

L. Yates et al., *Knowledge at the Crossroads?*,
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At the same time, nations around the world have been concerned with the role of the subject history in the formation of national identity and social integration (Yates and Grumet 2011). Within these debates, history is not considered in relation to its vocational utility but rather in terms of the kinds of people being produced through schooling and in relation to the question of what knowledge (or beliefs) students should acquire about the world, their country and their place in it from education. In Australia, debates over history and its teaching have been particularly fierce and politically driven, and heavily concerned with the messages politicians want students to know, and with the role of the history subject in teaching young people about Australia and the world and to form values and identities appropriate to being an Australian citizen (Macintyre and Clark 2003; Taylor and McGuyver 2012). The new national history curriculum framework has been finalised in recent years and is being rolled out across the Australian states and territories. However, its program is far from settled and the 2014 review (Donnelly and Wiltshire 2014) criticised its current form as biased against Western traditions and called for further amendments to the content.

When we spoke to the history teachers taking part in our study, we were interested in how they saw the value of studying history in a context where history has been so hotly debated and where the structure of curriculum and the place of disciplines have been in flux. We asked them what they saw as the heart of their subject, what they hoped students they taught would get out of it, as well as about the sense of the discipline they had from their own university studies.

Without exception what teachers most emphasised and talked about at length was the value of learning to do historical work: the education or training in analysing sources and documents and accounts by different historians, and the training in learning to build an argument and essays from this that were critical (analytic) but well supported by the sources and evidence. When asked what makes history distinctive, one history teacher from a private school in NSW put it this way:

> It's very much research based. I remember having a discussion about plagiarism with a business studies teacher and I said, "We don't seem to have that problem," and she said, "Well, that's because you reward research and quoting. You encourage it." History is a critical study of the past and I think it supports literacy and analysis in a way that other subjects simply don't. It is a distinct discipline […] it is distinct in the amount of depth that people need to deal with it, the passion and expertise that comes with it and the outlook that it gives […] I think it's an outlook that, well, the distinguishing feature is that it's a critical study and therefore involves dealing with evidence and interpretation. And it allows, I think, the training it gives, is the ability to weigh concepts, to weigh research findings and produce a result or a finding.
>
> (Teacher 29)

The teachers tended to emphasize the analytical approach history offers rather than content when asked about its value. One teacher working at a Victorian state school noted that:

> I'm really interested in the skills that you need to be able to be a history student, so it's not—I'm not so wedded to curriculum documents that have content. I mean, I understand that they need to be in there, but it's really about the skills involved, you know, especially the analytical stuff.
>
> (Teacher 24)

Another senior teacher from Queensland similarly felt that in her teaching '[i]t's not about feeding them knowledge any more, it's about actually making them critical thinkers and critical writers so that they can use the skills they've learnt in history in any other discipline and hopefully when they open up the newspaper' (Teacher 28).

Content knowledge was seen as transient, while the skills history taught were framed as more significant and longer lasting:

> I don't think so much in terms of content, I would you know, defy anyone to [remember] what they learnt in Year 9 history once they got to university, or once they get to Year 10 actually.
>
> (Teacher 7)

> And then especially as a second year school teacher now, I'm focused more on the skills. I think they're probably the most important thing that you can instil in your students because the content, the material they'll often forget, but it's the skills that they use for the rest of their life that they develop in the study of history, is more important than the content.
>
> (Teacher 20)

This was not because the teachers saw content, or the 'facts' or story of history, as irrelevant. History teachers often teach both English and history, and a number of those we spoke to felt that the difference with history was in the necessity to engage with real events and take account of what was actually said and written. They saw both as having a role in teaching empathy and understanding of people and the social world but history teachers valued the way their subject was based on and had to be accurate to 'real' world happenings:

> It's quite different from English, which is my other method and what I know. So you're not just analysing and interpreting, you are using facts as a basis to interpret things, not just have your own personal response to a book or characters or what you can identify in there. (Teacher 3)

> I think that whole focus on empathy is probably an important thing in history. And obviously it can be in literature too but we're talking about real people and events with history.
>
> (Teacher 8)

> You learn about humanity in a way that you can't with other subjects […]. I mean [you can with] English to a lesser extent, but English is more to do with the individual response I think as opposed to history which is more about an individual and a communal response.
>
> (Teacher 45)

In other words, the teachers thought history made available to students a certain kind of intellectual skill or capacity but in a subject where these are situated in and against real world complexity. A senior teacher from Queensland put it this way:

> History is the one I see which has a particular discipline that is focused on students building up knowledge […] And it's actually focused on engaging students in debate and discussion and encouraging students to have actual views on issues that are meaningful.
>
> (Teacher 18)

History teachers we interviewed wanted to teach students about how sources and accounts are socially constructed but not in the way this is sometimes caricatured in media comments as either simple relativism or carte blanche as to the interpretations that can be made. Instead, this was about students learning how historians operate, as well as about grappling with evidence and actual history (the past). In line with the arguments of the social realists (Moore 2007; Muller 2000; Young 2008), history teachers saw the study of the disciplinary (and disciplined) approaches of history as important and as a more valuable, ongoing and less superficial way of teaching skills such as communication than a direct skills approach.

The history teachers we interviewed also strongly believed that their subject offered broad social usefulness. A number of them spoke about the vocational relevance of history skills—learning to investigate and question, analyse and synthesise materials and develop a clear argument. For example, one teacher said,

> it sounds like a big cliché—everyone says "oh studying history will help with all these other careers that have nothing to do with history"— I really do think it's true though. I find that students who are passionate about history generally are interested in the world, they're interested in understanding themselves in relation to world history and the context of society—their own society and their own community. They know to ask questions and I suppose the best training to give them is to teach them how to ask questions and to constantly show them how they can get more information from something by approaching from different angles.
>
> (Teacher 36)

Other teachers talked of the relevance of history to high-powered careers, such as law or medicine. A teacher working at a private school commented,

> I get kids and parents, they say "why bother learning history if it is just old stuff and dead people then what's the point?", but I think the way that it impacts and shapes culture, the way that it allows kids to […] question and also the research skills they develop. […] I mean just as far as uni goes, you know if they're doing a law degree, if they're planning a wedding, you know the skills that you get from trying to find different bits of information it comes in handy across the board and not just in terms of educationally but I think as life skills.
>
> (Teacher 47)

Many of the history teachers also framed the value of history in terms of the development of critically-informed and critically-literate citizens, able to participate in informed debate. When we asked what they hoped the students would take away from their subjects, they often talked about students questioning and intellectually engaging with the world around them, and the value of learning to distinguish and evaluate different source material given the rise of web-based materials and communications:

> You know people will say, "I hope they take away a passion and interest in the past." Yes I suppose, but I'm more interested that they use the knowledge [of] that passion and interest in the past in order to take the world forward. I don't particularly want them to, you know, get into the university of the third age mentality when they're 17 years old. Yes, I want them to think about the future.
>
> (Teacher 17)

> I think most history teachers would see their discipline as kind of creating a global citizen. I like to think that by learning history my students start to understand how the world around them works but also be tolerant of difference and understand difference and that kind of thing.
>
> (Teacher 46)

> I would like them to have the love of history and a continued interest in history but at the same time I want them to have skills that will help them to look critically at things in their future, not to take things at face value, to understand cause and effect, to be able to look at different perspectives which is really important and to be able to empathize and all of those sorts of skills as well.
>
> (Teacher 48)

> I suppose largely what I hope that they will take away is sort of a capacity and an inclination to think critically about things that go on in the world around them. To be able to recognise that […] you need to question everything and that […] questioning everything doesn't just include checking the three websites that all plagiarise from Wikipedia in the first place anyway. So that's what I think is probably the main thing that I can achieve across the board […] because obviously not everybody is going to develop a love of history and not everybody is going to go on to study it further but […] that's what I want them to take away from my classroom.
>
> (Teacher 51)

History teachers (and university-based historians, discussed in Chap. 9) make a convincing case for the value of their subject, and it is one that emphasises building a certain kind of conceptual and powerful ability to operate in the world. However, this is a quite different case than the one that regularly dominates political and public debates about the history curriculum. Those debates overwhelmingly focus on content, and on what kind of national and international story and values should be emphasised. Teachers overwhelmingly saw the value of history as its mode of inquiry, not the facts or content or story. When we asked our interviewees what they saw as valuable and distinctive about history, they were wary of rationales that emphasised one particular story of the past. One Queensland history teacher put it this way:

> I'm also a little concerned again that the history… that jingoism becomes patriotism. I believe for example, and as an ex-soldier, it's still okay to criticise or at least critique ANZAC Day […] what it really is, what is it becoming. I feel that […] with some of the kind of political atmosphere today that some things are going to be seen as, "well you don't question things like that".
>
> (Teacher 29)

While for politicians and in the public and media debates the purpose of history is primarily discussed in terms of inculcating certain knowledge of history and certain values about who Australians are, for teachers, the value of history is learning to work as a historian, with less emphasis on the story history tells. This was not because they thought knowledge about the content of history was unimportant (both in terms of what topics are selected and what kind of story is told), or that they saw no role of their subject in forming values and orientation to the world, but there was a noted de-emphasis and wariness about teaching history as a particular story of what happened.

History teachers noted concerns about content in the context of students who lack a broad skeleton framework of history to build on as a backdrop (students who had not heard of Hitler was given as one extreme example of what would be of concern). However, they primarily talked about content in relation to whether the selection of topics was seen to gel with what students will be interested in (most often raised in relation to concern about the amount of Australian history in the framework) or when they are concerned that they are being asked to enforce a particular story or values rather than having an approach to the story via a critical treatment of evidence.

For the most part, teachers were primarily concerned with having the time to develop historical skills (work with evidence etc.) and to allow their students to develop a love of and curiosity for history and with what is happening in the world. They focus on the particular value of history and its approach as a discipline, its disciplined way of engaging actively with the world, a way of investigating and understanding that will have value beyond the particular content and stage that is being taught. The main values they emphasise are intellectual ones of how to deal critically with evidence and argument.

National Curriculum and the Problem of Content Overloading

However, the emphasis of history teachers on the inculcation of intellectual values and skills does not mean content is not a curriculum issue for history. The selection of framework and topic focus matters in relation to what is able to be achieved through the teaching of history, and remains a political question since content issues are not neatly resolvable (as arguments of social realists discussed in Chap. 2 might suggest) by assuming it can be derived from some logic of 'the discipline' itself.

In the case of history, the decision to have a national curriculum authority and a national framework for the subject raises inevitable questions about what content should be prescribed and what should be optional, of what should be the big picture selection from history that students learn about as subject history. (A decision to not prescribe any common framework would equally be a decision in this context.) We conducted our study at a time when the national curriculum reform across schooling was in the process of development, and at the time of our interviews the new national history curriculum had been designed, consulted and refined, but had not yet been trialled, and those we interviewed did not necessarily have detailed or accurate knowledge of what it contained. Nevertheless when we asked teachers to comment in general on where they saw history teaching heading in the future, most offered strong opinions on what they knew of the current reform.

Importantly, and contrary to much that has been reported elsewhere about the controversial nature of having a national curriculum framework, and the strong state differences in how history has been previously done, overall the teachers

tended to see the development of a national history curriculum as a positive development. Just over half of those who chose to comment were positive about the work of the subject framework development committee, and the refreshment this national attention gave the history curriculum. Of these, a number of the teachers positively approved the framework in moving the overall curriculum into a broader 'world history' perspective, with more attention to Asia than previously. Others were approving in more general terms, seeing the renewal as 'a great opportunity to change things that aren't working or can be improved' (Teacher 20), or saying that it takes time inventing and re-inventing curriculum and this will allow teachers to put their own effort into developing good lessons (Teacher 32), or that it is 'more skills-based' than what they had been doing previously (Teacher 48). The history teachers did appear to see the value of having a broad repertoire of knowledge about the world, and many who expressed positive comments about the reform did so from the perspective that this broad framework of what is appropriate in terms of the historical knowledge selection is not timeless, but needs 'refreshing' from time to time.

Despite this, teachers had a number of concerns about aspects of the new move to a national framework. On the whole these concerns were less about the overall content framework than from their interpretation of how the new curriculum would work in practice.

First, the history teachers saw in the new curriculum a tendency to overload the prescribed content and were concerned that in history there is a trade-off between time allocated and what can be done properly as historical work. If too much content has to be covered, they felt it would be necessary to take a didactic and assessment-focused approach that would lead to a hollowed out subject forced to emphasise memorisation and skip through what was valuable about learning to grapple with evidence and interpretation. The curriculum framework documents were developed over a number of stages, with built in public and professional consultations on framing and shaping papers as well as the curriculum framework, and there were concerns this had led to the incorporation of too many interests and specified details. The public circulation of documents and the search for a reasonable degree of consensus around the country tends to lead to things being added rather than taken away. In part this is because the public and political sense of the rationale for history is so different from the professional one—with a large focus on the story of the country and the world that students should acquire.

The teachers interviewed believed from experience that what will be achieved (and learned by students) will be very different according to the amount of time allocated to the subject in the timetable. They saw some mismatch between the new status being given to history as a priority and a mandatory subject, and the small amount of time it will effectively be allocated within the timetable. NSW teachers in particular noted previous experience in that state with not providing enough time to get through mandated history content:

> That's one of the lessons from New South Wales, that […] if you're only given this amount of time you can't pile up a whole lot of content in that. You've got to draw back and so, how ambitious can we be with what to do with that time? […] There are other

> implications there when you suddenly say all Years 7 to 10 are doing history […] and we're giving that small amount of time and it's compulsory. In schools that can just become a timetable problem.
>
> (Teacher 9)

In Victoria, many teachers also noted issues with the examination requirements that they felt would require them to pass down a content-driven and limited version of history. (A number of the university history academics we interviewed also noted concerns with having to work with formulaic student responses in first year, which they attributed to the influence of such examinations). One year 12 history teacher advised,

> Well sadly what they need to do is sit an exam at the end of the year, that's worth 50 % of their marks. So therefore the SATS [school-based assessment tasks] that I set throughout the year mirror the exact type of work that they need to be able to do in that exam…so, there isn't room in that sense [to do anything else]. In my teaching of it …I mean we have to go very factual and in chronological order and make it lots of facts. And it's about the roles of leaders and movements and events, and challenges and crises, and there's all these events they have to look at.
>
> (Teacher 7)

History teachers are aware that there is a big gap between prescribing what should be learnt and succeeding in having students know and care about it. They are concerned that making history mandatory might actually turn students away from it. If too much is crammed into the school curriculum to be taught and tested, students will not learn history or engage with it but instead memorise facts and lists they may well forget.

One history teacher from a private school in Victoria put it this way:

> For us, the national curriculum is a disaster […] the courses are prescribed and the content is prescribed and we don't have enough time to do the things that are required […] it has some manoeuvrability, but at the end of the day, the content is unteachable in the time we have available. [It's] such a disappointing feel that you've got to rush through the content to sacrifice the understanding.
>
> (Teacher 1)

Another state high school teacher saw the new curriculum as overloading facts and checklists in a way that restricted how teaching could proceed in the classroom:

> looking at the document for the Years 7 to 10, I don't know how many events they've got—it looks like a checklist, it looks like checklist history, that's my—it's a checklist of history […] there's so much there to teach that you wouldn't go into anything in depth. Even though I think they actually called some areas […] something like areas of depth or something like that, but they're in fact…[trails off] That's ironical because there will be no depth in what you teach, you'll just be ticking off the box, "Oh, quick, we taught the Magna Carta, now we taught this, and how we taught this king and this king and this battle and this—it is just a checklist, points. So I think that will actually not do anything for the study or teaching of history at all.
>
> (Teacher 7)

A second issue that teachers were concerned about in the introduction of the national history curriculum was where the imposed framework could mean that a locally developed successful topic could no longer be taught because it did not fit the focus of the curriculum for that particular year. Teachers' resistance to change is a well-known issue in the curriculum reform literature, and many previous state-based curriculum reforms in Australia had foundered on this problem—as had the previous attempt in the early 1990s to move from different state curricula to national consistency (Yates et al. 2011). But the teachers' responses here, in explaining what might be lost in teaching within the new framework, also signaled how they understood the power of history and the point of doing history. One Queensland based teacher, talking about the value of incorporating Indigenous content through locally relevant curriculum, put it this way:

> I think the National Curriculum has lots of merit but I also feel that it doesn't allow for schools to have local content. Again I can give you an example: in Year 8 we used to teach about the local Indigenous people the Jagara and the Ngaro people, but we can't do that now […] that unit has gone by the by.
>
> (Teacher 29)

The teachers were also concerned where topics were mandated which in the interviewee's experience were not appropriate/of interest to students of that level. They highlighted the potential of a compulsory history curriculum to produce counter-productive effects, especially associated with an expanded curriculum focus on Australian history. Many of the teachers we spoke to report familiar claims (see Clark 2006) that students, particularly in the lower year levels do not like Australian history, and were worried that too much Australian history at those levels might turn those students off continuing with history in later years. One teacher noted that she loved Australian history but saw it as potentially more suitable for older students:

> I remember trying to enthuse a very senior class with—very good class— with the merits of federation and saying to them, you know […] I spoke for about five minutes, and concluded by saying, "Isn't that an extra ordinary thing that we made a country, we created a country, not by going out and killing a million people, but by just having a series of meetings and we made a country? Isn't that extraordinary?" […] And they thought for a second and said, "No. That's very boring." And some of the more interesting aspects of Australian history are social. I suppose I would argue that appeals more to an older group, the social change, than it necessarily does to younger.
>
> (Teacher 9)

(This example is also notable (as an interesting counter-example) in terms of the political debates preceding the 2014 Curriculum Review, where politicians had been quick to blame teachers for teaching a 'black armband' view of Australian history.) Another teacher noted,

> As the kids get older, it's generally understood that most kids hate Australian history in year 9 and then they hate history, so it's very hard for us to bring that back in again in year 10.
>
> (Teacher 39)

The history teachers we interviewed were concerned about the need to engage students—without which they felt the subject was pointless. They drew on their own experience of local and demographic and gendered and developmental specificity in what does more readily engage students. Their responses indicate that teachers feel some tension between attention to the big story or framework that history should provide for students, and learning history through a detailed more particular focus. Even if the curriculum reform leaves apparent scope for some element of both, teachers see the reality of the limited amount of time to be given to history as forcing some choice between either focusing on the national framework and what it will test or on developing good local projects. One teacher put it this way:

> I guess certainly in year 7 to 10, I would like to see loosening of the content of the curriculum so that you can have more time to really engage in areas of interest. I'd like there to be some sort of area where you can actually go "this is what my kids are interested in and I want to run with it". Because at the moment it's very inflexible […] I just had a quick look at the new National Curriculum that's coming out in history 7 to 10 before I came and I notice now that you pick one sort of culture, you can do Egypt or Greece or Rome now, I'm not just talking about that kind of flexibility, I'm talking about once you actually pick Greece for instance or pick Egypt, that you can actually pursue an interest within that topic. So if you get your kids and you start teaching them the general kind of ideas about what's happening in Egypt and they show a real interest in pyramids for example, you can actually then maybe not teach something else and actually use that time to do real knowledge building activities where they can actually go away and engage with the material and create something that has meaning, something that is new, that is not just, "here is the text book, let's read the information".
>
> (Teacher 49)

A strong emphasis was placed on the importance of offering and selecting topics which students could connect to. There was a sense that for history to work students needed to be interested in the content or topics—and for many this was not merely a matter of pedagogy but related to the kinds of things adolescents were interested in or not interested in, as well as to the ability of teachers to convey what engaged them. Teachers saw that the content selection of the subject mattered in terms of what students got out of it at school and in terms of whether they chose to continue studying history past the compulsory years. In part this reflects their understanding of what it means to do history: that doing and getting value from history requires engagement with detail and subtleties.

In terms of the purpose of the subject many of the teachers we spoke to accept in principle the need for some broad decisions to be made about what is in the history curriculum overall, but were concerned about the kinds of decisions occurring in relation to content selection. These concerns stemmed as much from their interpretation of the way they thought the curriculum would work in practice as any in principle objection to its treatment of what matters historically. The curriculum argument was that the value of including history in the school curriculum is tightly coupled to the need for depth and detail and expertise and passion on the part of the teacher—that teaching just from a specified framework would strip out the kind of complex engagement that makes history powerful. Teaching that

is simply about key points is not the same thing. In order for students to engage and take up the potential that history offers as a subject, teachers see the need to take account of students' demographic and developmental characteristics, and their associated motivation.

Here the role and value of history as a school subject is impacted not just by explicit values of those who write the curriculum frameworks and produce the textbooks, but by the curriculum reform process. As we have discussed elsewhere (Yates 2012, 2013) the very act of moving curriculum to a national public authority that has a direct link to politicians and which aims to actively communicate to the general public has some effects. It tends to produce both overload (people want more content covered) and hollowing out (teachers and students required to juggle a large number of competing demands are likely to focus more strongly on the test scores and how these are obtained).

As we noted earlier, the interviews for this project were carried out in 2012 and 2013 when the initial framework for an Australian Curriculum for History had been approved by the relevant authorities, but when it was at pre- or very early stages of implementation in different states. As a representative of ACARA pointed out in another of our interviews, not all the concerns teachers were raising reflected accurate knowledge of the curriculum framework and the scope it was building in for choice and local refinement and modification. However our interest in the project and in this chapter has been on the ways the responses here reflect how teachers see what is important in school history curriculum, rather than as an evaluation of a particular curriculum iteration.

As we also mentioned earlier, in January 2014 the Abbott Government commissioned a review of the Australian Curriculum process and content, citing among other matters concerns about over-crowding, and concerns about whether the curriculum reflects a sufficient emphasis on 'the benefits of Western civilizations' and sufficient celebration of the national story. In response the body representing history teachers, the History Teachers Association of Australia, made a submission that was very strongly supportive of the history curriculum framework that had been developed. The submission (HTAA 2014) emphasizes the involvement of teachers in the development of that framework and resources.[1] It strongly rejects the concerns about 'balance' that are a specific term of reference for the review:

> [re] "Robustness, independence and balance of the content of the Australian Curriculum".
>
> As stated previously, HTAA considers statements made regarding a perceived left wing bias within the History curriculum have the potential to cloud the review process, and as such, wish to go on the record of highlighting that the content within the History curriculum is robust and balanced.

[1]The issue of which teachers become involved in curriculum bodies at the state and national level and how similar or different their perspectives are to their subject colleagues is another matter of interest, given some of the views quoted in this chapter.

> The organization and structure of the Australian Curriculum: History aims to avoid an ad hoc teaching of History and avoid repetition of content. Research conducted in Australia and other countries has shown that repetition and an ad hoc approach to teaching contributes to students' lack of engagement with History, especially the national history of a country.
>
> (HTAA 2014)

The submission further argues that the organisation of historical content and skills 'reflects the developmental stages of students', that students are formally introduced to Australian history and heritage in Year 3 'via an exploration of national celebrations', and that the concept of Western Civilization is introduced in year 7 and continued through year 8 and 9.

The *Review of the Australian Curriculum* (Donnelly and Wiltshire 2014) begins its review of the history curriculum by citing a number of submissions that argue there is insufficient attention to Christianity and its benefits. It goes on to acknowledge that the HTAA and a number of other bodies (including the Catholic Education Diocese of Parramatta) defend the balance and robustness of the curriculum but implies there has been an 'orchestrated campaign' given that 85 submissions included the line 'I reject the idea that the syllabus reflects or presents an ideological bias' (Donnelly and Wiltshire 2014, 178). The recommendations of the review were that the curriculum should be 'revised in order to properly recognize the impact and significance of Western civilisation and Australia's Judeo-Christian heritage, values and beliefs'; that a greater conceptual narrative is needed to underpin the episodes and movements of the curriculum overall; that the amount of choice should be reviewed to ensure that the curriculum covers 'all the key periods of Australian history, especially that of the 19th century'; that the strengths and weakness of both Western and Indigenous cultures should be better acknowledged; and that '[e]specially during the primary years of schooling, the emphasis should be on imparting historical knowledge and understanding central to the discipline instead of expecting children to be historiographers' (Donnelly and Wiltshire 2014, 181). (Note that the teachers we have interviewed in this project who are quoted in this chapter are all drawn from the secondary school phase of education.)

As we write, some revisions to the *Australian Curriculum: History* have just been released, but the point we have been drawing attention to in this chapter continues to be the kinds of perspectives and points at issue in the curriculum for history.

Conclusion

Overall, findings from this project suggest there is a significant difference of emphasis between how the role of history is understood at the big policy level and at the professional and practitioner level. National curriculum reforms, especially in relation to history curricula, are often concerned with what students should

learn about their identity as part of their particular country. This is something that is visibly revisited in times of war, as borders change, as apartheid is ended, or as the country wants to indicate a changing relationship to the world beyond the nation state (Yates and Grumet 2011). The longstanding curriculum question 'who should they become?' (Hamilton 1999) has been the subject of attention both in the agendas of many curriculum reviews, and in the work of critical sociologists looking at the work schools do. The values and identity implications of the history content selections were a central point of contention in the terms of reference of the curriculum review commissioned by the Liberal Coalition Government.

At the same time, curriculum reforms are also concerned with the intellectual capacity children develop in the course of school, that is the quality of the foundations they are given. Here history teachers talk at some length about the strengths of history as a disciplinary intellectual foundation. They see it as a study that is inherently complex and simultaneously involving grappling with 'real' evidence and with interpretations of such evidence. They see it as developing analytic and critical skills, the ability to weigh and understand various types of evidence and to bring different interpretive frames to bear on these. They also see it as nurturing communication, and the ability to put together and develop arguments taking account of evidence and audience. The complexity and subtlety of both the analytic task and the writing tasks are seen as more challenging and offering a more substantial foundation for a variety of intellectual tasks beyond school than direct teaching of 'communication skills' and the like.

So, in broad terms, the national policy focuses on the identity and values formation role of history; the teacher responses focus on its value as a disciplined intellectual foundation—and yet it is the first set of concerns that is the reason why history is being given such mandated emphasis to begin with. Nevertheless, teachers' concerns about the way politicians see history in over-simple terms, as a series of messages about national values, reflects not just a difference of understanding about what is important about the subject, but a practical recognition of counter-productive effects that can be produced if proper attention is not allowed for the way the subject needs to engage with students.

For history the issue of a national framework and its realisation is particularly problematic. If the story students are to learn in school about Australia and the world matters, then there is a good case for having some serious refreshing of the scope of history as the subject panel did, not simply leaving this to local choice or to textbook manufacturers. But as interviews in our project make clear, it is not possible to cover all of history; the content selection cannot simply be derived from the discipline itself; and there is not going to be unanimity in a democracy on what matters most in this story, particularly in a political system where the major parties are to some extent differentiated by their emphases on this matter.

Nevertheless, it is possible to place too much emphasis on different views about the big framework. Teachers on the whole accepted both the need for some refreshing of such a framework, and (with the potential exception and problem of Australian history) the broad shape of this, with a world history context. The major problem for teachers is not the selection and overall shape of the framework

they have been given, but its quantity and detail. From their point of view, teaching lists of facts to be memorised is not teaching history - and attempting to prescribe a thoroughgoing framework of historical knowledge together with development of historical skills over each stage of schooling as the new national curriculum was required to do, in the short term at least, is seen as having that result.

References

Clark, A. (2006). *Teaching the nation: Politics and pedagogy in Australian history*. Carlton, VIC: Melbourne University Press.

Donnelly, K., & Wiltshire, K. (2014). *Review of the Australian curriculum final report.* Canberra, ACT: Australian Government Department of Education. Retrieved from https://docs.education.gov.au/documents/review-australian-curriculum-final-report

Hamilton, D. (1999). The pedagogical paradox (or why no didactics in England?). *Pedagogy, Culture & Society, 7*, 135–152.

HTAA (History Teachers Association of Australia). (2014). *HTAA submission for the review of the Australian curriculum*. Retrieved from http://www.historyteacher.org.au/wp-content/uploads/2009/01/HTAASubmission_AustCurricReview_Feb2014.pdf

Macintyre, S., & Clark, A. (2003). *The history wars*. Carlton, VIC: Melbourne University Press.

Moore, R. (2007). *Sociology of knowledge and education*. London: Continuum International Publishing Group.

Muller, J. (2000). *Reclaiming knowledge: Social theory, curriculum and education policy*. RoutledgeFarmer: London; New York.

Taylor, T., & Guyver, R. (Eds.). (2012). *History wars and the classroom: Global perspectives*. Charlott, North Carolina: Information Age Publishing.

Yates, L. (2012). My school, my university, my country, my world, my google, myself…What is education for now? *Australian Educational Researcher, 39*(3), 259–274.

Yates, L. (2013). Revisiting curriculum, the numbers game and the inequality problem. *Journal of Curriculum Studies, 45*(1), 39–51.

Yates, L., Collins, C., & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: State cultures and the big issues.* Carlton, VIC: Melbourne University Press.

Yates, L., & Grumet, M. (Eds.). (2011). *Curriculum in today's world: Configuring knowledge, identities, work and politics*. New York: Routledge.

Young, M. (2008). *Bringing knowledge back in: From social constructivism to social realism in the sociology of education*. London: Routledge.

Chapter 7
The Physics Curriculum: What Is the 'Discipline' that Needs to Be Nurtured?

In Chap. 3, we highlighted some of the trends and issues faced by physics as a discipline or subject component in universities and schools. In this chapter the focus will be on the physics teachers in secondary schools who were interviewed for the project and how they view such matters as what is important in building learning and foundations in physics at school level; how they see the value of physics as a subject area; how or whether they are concerned about declining student numbers.

Physics, like history, has had to face in recent years questions about what should be included within the curriculum at the school level. Prior to the development (still ongoing) of the Australian Curriculum, the states all determined their own physics curriculum. For the three states from which interviewees were drawn for this project, physics is incorporated within a general science curriculum at years 7–10, the early and middle years of secondary school. In years 11 and 12, the years of senior school and the final higher school certificates, physics becomes a stand-alone subject and from these levels on is an optional subject. While there is little public disagreement that physics and science are important, a number of curriculum changes have taken place over recent decades in relation to physics and science more generally. Across the states the year 11 and 12 physics curriculum has seen a range of iterations and while there remains a large amount of overlap in the content covered, each state has developed its own distinctive aspects. Through the interviews we found that among physics teachers there is considerable overlap but not necessarily an easy consensus about what needs to be taught, and at what stage. Traditional state differences in curriculum topics, teacher preferences, student gender, student engagement and perceived accessibility were just some of the influences on the kinds of physics knowledge that were seen to be important.

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Teachers' Descriptions of Physics

In interviews, many of the characteristics of the discipline discussed in Chap. 3 were reiterated by physics teachers. They were largely at ease with explaining their discipline and there was a great deal of correlation in the descriptions of physics given in the interviews. Physics teachers see physics as a discipline that describes why and how the physical world works.

> Physics to me explains how things work, why things work, physics is the fundamental science.
>
> (Teacher 6)

> It explains why the world is the way it is.
>
> (Teacher 42)

> It is the studies of the laws of the universe, so if you're studying the universe, you are actually studying everything.
>
> (Teacher 21)

> It is basically finding relationships between phenomena in the natural world.
>
> (Teacher 5)

Many physics teachers moved freely between describing physics as a discipline and talking about the teaching of the subject physics. They conveyed an understanding that physics works with paradigm consensus, and pursues the development of universal laws. Reflecting the literature and our interviews with physics academics (discussed in Chap. 9), teachers spoke of how physics understanding can be condensed into a few important relationships or laws. They were often quite specific in wanting students to have an understanding of a few key but important concepts at particular levels of their secondary schooling.

> physics is different to other sciences in that it is based around few ideas and you need to know those few ideas very well. Once you know those few ideas then you pretty much have a good understanding of physics in its entirety.
>
> (Teacher 26)

> I'd say there's a lot of valuable things they get from physics. One is an appreciation of the connectedness of everything around them —to see those universal laws, simple universal laws apply in so many contexts. They see that the whole…they see a connectedness in their own world, and I think the universe; so there's that sort of high order […] it's fairly abstract, but I think it's important that they see that.
>
> (Teacher 13)

> At my previous school the curriculum coordinator said, we want to have the basic ideas that you need to have covered before the kids get to year 11. And I said, I basically need [them] to know that energy is transferred and transformed in a variety of contexts, that's all I need, and I need some sort of sense that forces are applied externally to objects so that there is a distinction between energy and force. […] That's all I need…the chemistry teachers put down a two and a half page list of things kids have to know and the biologies had about a page and a half —and I had two lines.
>
> (Teacher 16)

In describing what is distinct about the discipline, many teachers compared physics to other science disciplines and subjects, bringing out the dominant view that physics is very much a fundamental discipline that underpins the other sciences.

> Physics is about why things happen and how things happen. And then all the other sciences are applications of that.
>
> (Teacher 6)

> It is sort of overriding the sciences, in a way […] So if you understand the physics, the chemistry flows. So does the biology.
>
> (Teacher 5)

The relationship between mathematics and physics was a common point of discussion within the interviews. Mathematics is very much seen as a core part of the discipline. Many identified the use of mathematics in the discipline as the major point of differentiation of physics from the other sciences and discussed the importance of mathematics in physics.

> It is a more mathematical science than the others. I find biology is very descriptive, chemistry though seems to be part descriptive and part mathematical, whereas physics is an applied mathematics.
>
> (Teacher 12)

> The main thing that makes physics distinct from others is the use of mathematics as a tool.
>
> (Teacher 10)

> Physics is applied mathematics, that's the bottom line, applied mathematics.
>
> (Teacher 53)

We asked the participants whether they identified as a physicist. The physics teachers, with almost no exception, identified themselves as physicists. For many interviewed their interest in physics was seen as stemming from a desire to understand how the world works, often from a young age, and they often saw these qualities reflected in their students. Many related to what the discipline is trying to achieve on a very personal level talking about the physics style of thinking as a personal characteristic. Teachers described the influence of their parents or previous teachers on their passion for teaching the subject and often conveyed this ongoing fascination with the subject and what it offers in the interviews.

> I think it is characterized by just the thirst to understand how the world works.
>
> (Teacher 5)

> It is in my nature to understand how things work and then apply that in new situations.
>
> (Teacher 6)

> So it really helps you to understand what's going on. I mean there are people who walk around this universe, go around the world, who see things and have absolutely no understanding of why, what and how they happened. And I can walk around the world and go, "I know that."
>
> (Teacher 11)

> It is very quantitative, it is very about measurement, very much. It has a very rich history, I think, a very exciting history and that's part of the fun of teaching it. It has an incredibly wide allocation and it is so fundamental to so many things in society and so many other academic disciplines. I think it is distinct in that way […] on the first day I say "you're really lucky because you are going to learn about the greatest intellectual achievement in our species."
>
> (Teacher 13)

The ability to think in a certain way 'like a physicist' was seen as specific and important to many teachers. This skill was something they saw as necessary to pass on to students doing physics, particularly at the year 11 and 12 level. The role of explanation based on fact, the ability to reason and solve problems from first principles were seen as core skills that students needed to learn and take away from the subject:

> your thinking skills, your ability to rationalise, put together arguments, be able to logically come to a conclusion from axioms—and also being able to create experiments to test ideas.
>
> (Teacher 5)

> I do think that physics is actually the one science, at school level certainly, that is interested in explanation.
>
> (Teacher 15)

> [It's value] in terms of practical skills [is] because it's one of the ones that puts the girls in, oh students, sorry, habit, in the position of having to solve problems, having to reduce, shear off the stuff that's not relevant to what you're doing, work out what the key things are and then build a logical argument that they then should be able to defend. I think that's an eminently transferable skill that is worth their while having.
>
> (Teacher 2)

And so the discussion of physics as a discipline and as a school subject proceeds with a great deal of unity between physics teachers. The themes of physics as providing an understanding of the physical universe, as being a foundational science that describes the physical world through a few important laws, and the importance of mathematics and being able to 'think like a physicist' were common threads throughout the interviews and portray physics teachers as having a strong notion of their discipline. In the following quote, this is described by a physics teacher who also teaches English:

> I think one of the things that was very noticeable in the Dip Ed, because I did Physics and English as my majors, those were my methods, [is] there is no debate about what constitutes subject physics […] no debate at all. And the education research in physics is therefore quite advanced. You don't have to argue about what you should be teaching. Instead you are just asking well, there's the concept, what is it that we need to do to teach it well? That is very markedly different from a subject like English. I reckon the first third of that [Dip Ed teaching method course] is, "What is subject English?"
>
> (Teacher 2)

In our interviews we asked teachers whether they considered physics to be a distinct field of study, with clear boundaries. At a broad level physics is seen as a distinct subject that is easy to recognise. Teachers do however recognise that at the boundaries of the discipline there is overlap with other disciplines and they find many of the recent applications in the field and newer discoveries interesting.

> There are clear links in areas of physics which are identifiable as being physics and always have been — looking at things, like laser technology, communication technology, astronomy and particle physics which has been in the news a lot with the LHC [Large Hadron Collider]—so those areas are traditionally physics. But then the line becomes very blurred with communication because you quickly cross that boundary that might be called engineering. And obviously applied physics is in effect engineering anyway. […] I think primarily yes it still remains a distinct field of study. There are some recognisable areas of endeavour which can be clearly identified as traditional physics but having said that, there's a significant overlap between physics and other disciplines now which are both drawing upon the skills of physicists but also with physicists drawing upon other disciplines as well.
>
> (Teacher 35)

What is Physics Education For?

Physics teachers' beliefs about aims and purposes for teaching physics came through in response to a range of questions but particularly when asked what they hoped students would take away from the physics and science subjects they teach. Physics teachers are well aware that not all students will go on to year 11 physics, university physics or careers related to physics; however they still believe that the subject is valuable for all, and they see their subject as being important on a number of different levels. The subject material itself is seen to be inherently interesting and teachers want to convey a sense of 'wonder and awe' for their students and enable them to get a sense of what physics can describe and how it is done. Teachers believe that physics is useful in that it enables students to be able to 'think about things in a scientific manner', to understand the everyday uses and applications of physics and have an understanding of how the world around them works. Alongside this they discussed the importance of the experimental side of physics and the ability to make predictions and test ideas and theories. They also expressed the need to 'make students socially aware' and expose them to 'topical issues' in society.

When discussing physics at the secondary level, teachers (as well as academics, see Chap. 9) were keen on wanting students to be interested in the kinds of questions physics deals with and to be excited about big issues. They wanted students to know about and do experiments related to physics in the everyday world, such as Newton's laws, and to have a sense of the scientific method and hands-on work. They see some basic level of physics understanding as a form of basic cultural knowledge that everyone should have.

Many teachers want to instill in their students an 'interest', 'curiosity' and 'passion' for physics and a knowledge about how the universe works.

> I think ideally, I'd love them to take away some enthusiasm for knowledge and human endeavor, human understanding of the universe itself as being valuable for its own sake.
>
> (Teacher 35)

> For most of them I hope they just come away with a bit of wonder and awe, you know, because physics is that big thinking stuff
>
> (Teacher 22)

In addition to these more aspirational motives, on a very practical level physics is seen to offer students an understanding of the physical world in which they live and driving a car was given as an example by a number of teachers as to where physics can be important.

> It will give you an understanding in situations like driving a car or where the laws of physics would actually be useful in saving your life.
>
> (Teacher 10)

> There was one girl that has ended up as a police woman. She's on traffic duty, and she said that they came across an accident, and she said, the box had fallen off the back of the truck, and so the guy said he wasn't travelling very fast, and they reckon he was speeding, and she said, "Oh, it's easy enough to calculate that out." So she did a couple of measurements, calculations, and came out with the answer. And she said, the other guy said, "How the hell did you manage to do that?" And she said, "Um, I just remembered it from year 11 physics." And she said, "so that at that time, it came in really useful".
>
> (Teacher 27)

> So my aim is—I mean, this was not my aim originally, but certainly one of the aims that I've found in life, is to remind students of those simple facts, because quite often I'm teaching kids who within a year of me teaching will take a driver's license and drive around in a one ton killing machine. And you can be the best driver in the world, and some kid can run out in front of you and you never know it.
>
> (Teacher 11)

Such short term practical examples were common and yet very different to the bigger picture views and purposes that most teachers discussed in relation to physics. These examples, often given alongside broad description of physics, appeared to be a way for teachers to provide a form of justification for why the subject is useful. These statements of practical usefulness were different from what was seen to be the broader value of studying the discipline and instead were seen as an added benefit. Alongside these practical applications of physics content, the skills developed in undertaking the subject are seen as advantageous.

> That's what I want them to be able to do. I want them to come out of the course being able to think like a physicist. I want them to be able to… [pause] think of a problem as soluble, [(laughs] I guess. That if they can work out, you know, work out what tools from their sort of intellectual toolbox they have that they could use to break it down, think of it as worth going back to first principles, in order to sort it out and to have a toolkit.
>
> (Teacher 2)

This was seen as particularly important given the current debates that involve science around climate change and nuclear power.

> What will an 18 year old who leaves our hands in science say about the data set that they have for global warming, for example, how will they engage with that stuff?
>
> (Teacher 16)

> I always say one of the main reasons I like delivering nuclear power is so that you guys, when someone knocks on your door and they'll [be] scare mongering you into thinking it's either the best thing in the world, the only answer, or the worst thing in the world and we ought to get rid of it as soon as we can. I said at least when you go to vote for some of these guys as a political entity you're going to be able to think from the position of knowledge.
>
> (Teacher 21)

Scientific literacy and problem solving skills are seen as important for students in the real world and as enabling students to be able to sort out fact from fiction.

> I would also like them to take away the capacity to think rationally, to make decisions based on factual material and to develop the skills which allow them to sort out fact from non-fact, facts from opinions because they're constantly being assailed with people trying to sell them products for example, that make all sorts of outrageous claims, and I think if we can bring students out of a high school science education with a scepticism to question, that is one of the greatest values that I think I could give students as a science teacher. If they can go away being sceptical and I mean that in the true scientific sense of the word, not just accepting statements without really saying "hang on where's the evidence for that?" and knowing how to sort out valid evidence from rubbish essentially.
>
> (Teacher 35)

Physics in the General Science Curriculum

Physics is largely included within a general science subject from years 7 to 10, although there are occasional examples of physics being taught as a stand-alone subject in year 10 or being taught within topic based subjects. Many teachers talked of wanting students to have a 'good foundation' or basic understanding of what physics entails. A number mentioned that the topics energy, electricity, motion and light were what tends to currently be covered at this level and few specific issues with these topics in their current form were raised. It was pointed out that these topics are often revisited over a number of years and that teachers often feel that students do not retain a lot of the specifics of a topic and so in their pedagogical approach they are 'teaching from scratch'. However it was also generally perceived that students' understanding did improve with each revisit. The role of 'demonstrations', 'practical work' and the 'experimental' side of the subject were seen as playing a key role at this level as they provide students with an understanding of the scientific method.

In relation to physics at this junior science level, the main concern teachers expressed is with students being able to differentiate between physics and the

other sciences that are taught within a general science curriculum. In other words, although some physics content can be taught without this being labelled as 'physics', teachers do want students to have a sense of the different sciences and their agendas. In practical terms they see it as relevant to students being able to make appropriate and informed decisions about their senior school subject choices.

> I would say probably more than anything, having been exposed to physics in general is more [important] than anything so they know what the difference between physics and chemistry and biology is. So when they come into the class [they are able to] really understand that what physics is about is about trying to find relationships, find mathematical relationships, to explain the physical thing that what we see.
>
> (Teacher 22)

> And there is a sense that the kids continue to come out of year 10 with no real sense of what it (physics) is except they think maybe Newton's Law might be involved. They've done some motion in year 10. But they don't get the idea that when they're doing optics they are doing some physics and when they are doing electricity they are doing some physics and when they're doing the astronomy in year 7, they're doing some physics. They don't get that sense of physics as a discipline.
>
> (Teacher 2)

The ability of students to be able to distinguish physics from the other sciences is an issue because students may choose the subject in the senior years and then find the subject to be not as expected. Many of the physics teachers interviewed teach at these lower science levels and spoke of the importance of physics trained teachers actively contributing to the curriculum and teaching at years 7–10 in the hope that students are exposed at least to some physics.

Senior Physics

The concern with physics as a subject choice in the senior years reflects a broader concern with the diminishing numbers of students taking up the subject. Physics teachers believe that this is related to the number of science teachers teaching physics without sufficient physics training. This problem was raised regularly in interviews both by physics teachers and physics academics. Having teachers without a physics background teaching the subject is seen to result in the physics aspect of a general science curriculum being downplayed, described as difficult, or taught poorly in comparison to the other sciences. It was felt that this leads to students not being engaged with the subject and then not going on to take physics in their final years of schooling when the subject becomes optional. And this problem is both circular and longstanding—fewer physics graduates are available so there are fewer physics-trained teachers.

> Mostly [school] science faculties are weighted more in the bio-chemistry sort of direction and they teach physics well generally but without that kind of confidence or vigor.
>
> (Teacher 2)

> So I think that if we have to go out there and teach them everything it's just not going to happen. If we want to expose them to physics at a junior level, it's not going to happen, because three or four of the teachers are going to teach it wrong, and it's not their fault; they're going to—because they suffer from the same common sense problem that afflicts 99.9% of the population. And they haven't got the practice to be able to say it in the correct words.
>
> (Teacher 11)

> I do a lot of physics with the junior science because [otherwise] they're not going to get much physics going through the rest of the school. Because there's very few physics teachers, and they'll get home-eco teachers teaching them science, they'll get PE teachers teaching them science, and these guys just sit them down with a textbook.
>
> (Teacher 27)

> I think one of the other problems with physics in particular is most of your junior teachers aren't physics trained. So I'm the only physics teacher in the school. So nobody's down in the lower [school], and again [this results in] that message that physics is hard. So when you've got the biology teacher trying to connect the clip-it electricity sets together and it doesn't work the first time, and they turn around and go, "Oh physics is really hard, girls," well, that message is being poured into their little heads: this is a really hard subject, only the elite can do it, and that's because that's exactly what those teachers feel.
>
> (Teacher 22)

These sentiments expressed in our interviews with physics teachers are in line with other discussions of physics teaching both in the media and in a number of the reports into the state of physics teaching in schools discussed in Chap. 3 (e.g. Harris et al. 2005; MCEECDYA 2004). The problems are known, but not easily changed.

For physics teachers and for universities in Australia, an ongoing issue then has been getting sufficient students (and sufficiently good students) to continue with physics. Here our interviews also suggest that this problem is not simply an artefact of the content of the physics/science curriculum, but is impacted by the broader rhetoric and framing of schooling itself: in particular the heavy emphasis on relatively short-term and visible pay-off. Students are being steered to think of education in terms of the rewards and extrinsic pay-offs and this is not the best climate to encourage students to find excitement in the discipline itself.

> Girls are um, quite strategic in their subject choices and they tend to be looking for advice about academic success more than about foundations of knowledge sort of argument.

This teacher went on to say:

> It's been quite noticeable here the fact that quite bright girls will make the decision not to do it because they think they can get a better mark somewhere else.
>
> (Teacher 2)

Influencing student choice is the gaming that goes on with students as they pick senior subjects that they believe will maximise their year 12 scores. As physics is no longer a pre-requisite for the majority of university degrees, many students believe that there is little value to be gained in taking a subject that is perceived

to be difficult. Conversely in some elite and selective schools students are encouraged to focus on the subjects with the highest difficulty weightings, including physics—but as a way of getting into Medicine and Law.

In coming into post compulsory physics teachers are keen for students to have a foundational understanding and interest in the subject. In years 11 and 12, teachers (and university physicists) do still want some building blocks to be put in place and they do believe in the value of recapitulating much of classical physics—Newtonian physics and electromagnetism for example. And it is at this level that teachers want students to start to understand the connections between the various physics topics. Beyond this however there are a number of points of contention. Mathematical competence is seen as essential, however the extent to which mathematics should be core at this senior school level is contested. Teachers also want students to be drawn into a practical involvement with experiments, to understand the 'scientific method' in a fundamental way; yet report that it is difficult to find the time it takes to include experiments within a content dense curriculum. And they want students to be excited about more modern aspects of the discipline as well as some of the breakthrough work physics is doing in the world: particle physics, quantum mechanics, medical physics, astrophysics and many other subjects. Yet as with the mathematics elements in the curriculum, the extent to which students should be learning these topics is a topic of some questioning as teachers collectively struggle to find the balance between engaging students in these areas and teaching them in a meaningful way. The concern here is that such topics can be theoretically too sophisticated for students at school to properly tackle. These various pressures will be presented below, providing a picture of how physics teachers struggle to reconcile these issues within the curriculum.

In interviews with physics teachers it is interesting that the inclusion of classical physics topics such as Newton's laws, light, energy and electromagnetism within curriculum was taken as a given. While some commented on the inclusion or not of specific laws or aspects of these topics, it was still seen that these areas have an important place within the senior secondary physics curriculum. While the need for this core content is largely agreed, tension does arise in relation to particular aspects of the curriculum. Many teachers had concerns about the 'dryness' of the Australian Physics Curriculum suggesting that it read like a curriculum from the past.

> Now we're going to National Curriculum. From the physics perspective, physics is probably going back now to classic physics like the 1960s in Australia.
>
> (Teacher 40)

A number of the issues expressed around content choice are strongly linked to ideas of student engagement. In recent decades, the state based physics curricula across Australia have moved away from being highly mathematical and theory based. Many new areas and applications have been progressively included in these curricula and there have been moves to a greater emphasis on understanding some of the core concepts rather than rote learning. However the Australian Curriculum has removed a number of topics that would have been taught under state curricula.

Physics teachers in Victoria had a particular problem with the removal of contemporary physics applications as it had allowed them to teach areas that they believe students found interesting and relevant. These topics included medical physics, astronomy and synchrotron physics (which was included in the curriculum after a synchrotron was built in Victoria). So there is concern regarding how the removal of these topics will affect student engagement and interest in physics. And these topics were seen by a number of teachers as being of interest to female students and so their removal also raised the issue of female participation in physics.

> One of the disappointing things about the new national curriculum which was just released is there's no astrophysics or astronomy; and in the Victorian curriculum we have both astrophysics and astronomy and both of those are the big picture wonder and awe […] And I mean, they're elective, you don't have to choose them, but a lot of schools are doing either one or the other because it's one of those things that the kids just love, they really lap it up and they're really interested in it and are excited by it.
>
> (Teacher 22)

> I'm very keen on the medical physics which I taught during teaching rounds and I think that's something that students will find easier to engage with, especially those students who think of physics being about forces and maybe a little bit too boring and too possibly basic and not enough animation or excitement in it. Whereas I think everybody can identify with medical physics because everyone knows someone who's had at least an x-ray and so I'm very disappointed that's been cut out of the course.
>
> (Teacher 40)

> … the new course has nothing to do with the synchrotron, with this monstrous synchrotron there. You know we should be—the notion of the national curriculum as it has been presented to us so far just takes no consideration into what kids could be interested in and are interested in…
>
> (Teacher 38)

Teacher:	It (the Australian Curriculum) looked really bad for girls in particular
Interviewer:	So why is that?
Teacher:	It lacked a clear sort of pedagogical narrative. It didn't take them, it didn't take kids from stuff that was reasonably easy to move into through the concepts to the more difficult stuff
Interviewer:	Okay
Teacher:	It seemed quite blokey. [laughs]
Interviewer:	Okay
Teacher:	I don't like to think of knowledge as gendered but the reality is that girls will tend to be more enthusiastic about some aspects of the course than others

(Teacher 2)

Similarly, the inclusion of more modern (and difficult) aspects of the curriculum such as quantum physics has traditionally varied from state to state and at the time of the interviews was undergoing further consideration in relation to the Australian physics curriculum. As with popular science in society, teachers (at least in some states) see the more modern aspects of the discipline as providing a particular point of engagement and excitement for students.

> If the only physics you're talking about is classical mechanics, which has a place, then you're really not telling the whole story – and it's impossible to do that with high school kids of course. But at least you should be providing a bit of inspiration about what are recent developments because that's often what excites kids. They want to know what black holes are and what dark energy is.
>
> (Teacher 35)

While for some teachers these areas are seen to engage students and provide them with a sense of where the discipline is moving, a key problem for constructing the curriculum is that the cutting edge issues can't always be properly dealt with conceptually at school, and there is not a simple linear path of building the foundations. For example in one version of the new Australian senior physics curriculum the Standard Model (a theory that describes the fundamental particles and how they interact) and Special Relativity (Einstein's theory of the relationship between space and time) are included. These are believed by many to be too mathematical and unable to be realistically understood by students at the school level.

> [Physics] has taken a much more philosophical view, if you like, a structured view, that if physics is about explanation then explanations have a development over time, and therefore all explanations are contestable, so you start with some explanatory tools such as particles and you finish up with those particles themselves being questioned as to the very nature of their existence. So one of the last statements about the Standard Model which we're trying to bring into the Unit Four, is to ask the question as to whether or not the particles themselves exist.
>
> (Teacher 16)

Teacher:	[The Australian curriculum is] very, very ambitious
Interviewer:	Okay
Teacher:	But frankly it was
Interviewer:	How was it ambitious?
Teacher:	Well, it was like references to the Standard Model in there. And I'm like, "Well, gee, I know some second years [undergraduates] who don't understand that."

(Teacher 2)

> … the way that the academic structure is changing under the national curriculum to having just the guts of physics in the—what's going to be Unit 3, and then relativity in Unit 4, is just wrong. The contents of Unit 4, are very heavy, and I think a lot of that stuff should be left to university for maturity of the person.
>
> (Teacher 27)

Equally there is a sense that many current physics teachers in secondary schools may not have received any formal training in the more modern topics and so these topics may be 'conceptually beyond' what they can teach.

Teacher:	I think it is probably too high level for most physics teachers to grasp
Interviewer:	Okay. The physics or the maths or…?
Teacher:	I think conceptually it's beyond quite a few physics teachers would be my guess

(Teacher 16)

Lack of conceptual adequacy in relation to physics topics is a concern for physics teachers, as they see poorly taught physics as leading both to misconceptions and to disengagement with the subject. Physics has a reputation as being difficult and student numbers have reduced in recent decades and having the subject being taught 'badly' is seen to aggravate these problems.

Running alongside issues of engagement with the subject is the 'accessibility' of the subject to students and what knowledge is required to give students a true understanding of the subject. Largely, physics teachers want the subject to be widely accessible to students and they want students to be excited by the content while also developing a strong understanding of the discipline physics. A tension arises as some teachers and academics see that in order to make physics more accessible to some students and in order to achieve a better understanding of particular concepts, that at the secondary level some of the more difficult mathematics would be better left out.

> You can get kids bogged down in numbers and things and they'll start thinking, "Oh, this is maths," and they'll lose sight of what's happening in the physics behind it.
>
> (Teacher 6)

The physics curriculum across all states shifted over recent decades from one that was mathematically intensive to now placing less of an emphasis on mathematics.

> Teacher: when I started teaching, it was basically just a list of equations
> Interviewer: That was your syllabus— equations?
> Teacher: Yes. Just a list of equations and you covered that area of physics, you know, it was a very succinct syllabus in those days that would have been the 1980s sort of time
>
> (Teacher 13)

And there is an acknowledgement among many teachers that this shift away from a mainly mathematics-based syllabus needed to happen (but not universally, and some similar differences of views are seen among university physicists about this matter whose views are discussed in Chap. 9).

> I can understand the rationale […] they did this to try and make the physics course more accessible to the average student. To make it accessible to more students.
>
> (Teacher 10)

> The maths, the maths, the content and the mathematics. It has been reduced greatly and I think every year, or every time they bring out a new syllabus what they have done is reduced the physics [equating mathematics and content with physics]—I think they are trying to make it appeal to a broad range of students, which is a great idea, you know, to have more kids coming into physics.
>
> (Teacher 12)

Physics knowledge is well understood to have a number of areas where misconceptions arise and so with the reduction in mathematics there has been a discourse of improving the conceptual understanding of physics students. Many physics

teachers mentioned research into improving students' conceptual understanding of physics and how they were drawing on research around these ideas and some trends within USA university physics education.

> So we'll get down to understanding the conceptual basis and modelling basis of what we're doing so that we can then operate on the surface again. Because ultimately the mathematics is just the surface, not at the deep level. So I'm looking for deep level to integrate what I'm teaching.
>
> (Teacher 16)

Others however argue that this move away from a mathematically intensive subject takes away from what is core to the discipline—the need to describe the physical world through mathematics. There was concern that over time and in some states in particular, physics curricula had gone too far down the path of reducing the mathematical content. This was also considered to have repercussions for students who went on to study physics at university and struggled with the level of mathematics.

> It needs to shift a little bit back towards that—to include a little bit more of that mathematical rigor.
>
> (Teacher 10)

> And certainly in year 11 and year 12 it should be more maths heavy; it's become far less mathematical. And the view is, [currently] you can do physics really without doing any year 12 maths, which I don't think is very good. So I would like to see a bit more rigorous mathematics in it.
>
> (Teacher 44)

These changes around the mathematics content and a greater focus on teaching and learning rather than written curricula have occurred alongside a trend towards a more constructivist and instrumental view of physics teaching. Concerns with relevance and application saw the inclusion in many curricula of more social and historical aspects. An example of this is the topic of generators. This topic has traditionally been included in many curricula to study the physics of electricity generation. In two of the states where interviews took place, the curriculum also now includes a consideration of how generators have influenced society. However, whether or not teachers support the inclusion of the social impact of physics, most physics teachers and physicists see these social elements of the curriculum as not physics itself.

> I've been teaching physics a long time and I've seen physics go from being applied mathematics to being a social science.
>
> (Teacher 12)

> I would hope that we see an improved balance, because we went from pre-2000 where physics, for example, was very mathematical and not much social content, not really social content, or much understanding of how physics relates to society. There has been some criticism that it [the change] went too far and too much time [is now] spent on the relationship between physics and society.
>
> (Teacher 35)

A number of those interviewed were concerned about the trend to include more social context and impact elements of physics in the curriculum and argued these were not truly physics (and these concerns were also evident in the comments of the academic physicists discussed in Chap. 9).

Physics teachers have a strong view of what is true to their discipline and what students need to know in order to understand the subject and think like a physicist. They object to seeing content included if they feel it is external to the disciplinary understanding that is required. And they disapprove of the removal of aspects they believe are integral to the core of the discipline. However if we consider the comments made earlier by teachers who would like some of the more modern aspects of physics included in the curriculum, this issue of the inclusion or non-inclusion of the social impact of physics is more subtle than it might appear. Physics teachers were concerned with the social role of physics (climate change debates was one example). The imbalance they objected to was where the framing of the subject becomes more directed to what they see as social science questions and objectives, and where the balance moves too far away from physics problems and principles.

Induction into the scientific method and the ability to test ideas through experiments are seen by many as core physics understanding. The move away from using experiments in physics teaching was mentioned by a number of teachers who believed it to be problematic. In NSW the number of hours to be dedicated to experiments in the physics curriculum has been reduced in recent years. Some teachers argue that a lack of hands-on experiments and 'grappling with openness' undermines physics understanding and is problematic for those students who have the capacity or interest to continue with it at university level.

Conclusion

While physics is often understood in the literature as having a very strong core knowledge and curriculum shape organized around a vertical hierarchy of agreed components, a close-up consideration of the experiences and views of physics teachers and physics curricula in Australia shows a more mixed and open picture than that might suggest. There is certainly agreement about some core foundational foci of physics, and broad agreement about the need to include some foundational and historical contributions to knowledge in this area. In this regard, teachers are concerned with conveying a sense of the *discipline* of physics—its agendas, problems, excitement, usefulness—and worried about the impact of having non-physics trained teachers whom they see as more likely to only be able to reproduce the idea that physics is difficult. But, especially at the senior level, questions about which specific topics should be included are more contentious, as is the overall balance in the curriculum between mathematics, hands-on experiment, conceptual emphasis, and social context and applications of physics.

So physics educators face problems about how to manage a range of different agendas. Cram in too much science in too little time, and students will default to learning to the test and dropping the subject as soon as they have an opportunity. Stay too much with 'what they are capable of understanding' and they may be cut off from what real world science is achieving. Spend too much time looking at what scientists do rather than doing science (including learning the hard mathematics) and you may get students enthused about science but lacking the ability to go on with it at university.

References

Harris, K. L., Jensz, F., & Baldwin, G. (2005). *Who's teaching science: Meeting the demand for qualified science teachers in Australian secondary schools. Report prepared for Australian Council of Deans of Science.* Melbourne: Centre for the Study of Higher Education (CSHE). Retrieved from https://cshe.unimelb.edu.au/research/disciplines/docs/Prep_Math_Teach_Aust.pdf

MCEECDYA (Ministerial Council for Education, Early Childhood Development and Youth Affairs). (2004). *Demand and supply of primary and secondary teachers in Australia*. Retrieved from http://www.scseec.edu.au/site/DefaultSite/filesystem/documents/Reports%20and%20publications/Publications/Teachers%20and%20teaching/Demand%20and%20Supply%20of%20Primary%20and%20Secondary%20School%20Teachers%202003.pdf

Chapter 8
Inward and Outward Facing Knowledge: Curriculum Purposes and Slippages

This chapter discusses an argument made by many who make a case for the specific value of discipline-based knowledge. They argue that there is valuable intellectual development for students in learning to focus on the 'inward-facing' disciplinary questions and methodologies, rather than framing learning primarily through 'outward-facing' concerns about relevance and utility. (This issue has also been much taken up from various critical perspectives in literature about education inequality). In this chapter we build on the previous two chapters and show that, for both history and physics, our interviewees do support a case about the need for some 'inward-facing' learning of the discipline (learning what kinds of questions physics and history ask, for example) as important if it is to be powerful or problem-portable. However, compared with some propositions that have been made by curriculum theorists, the teachers also accept the need for some 'outward facing' (that is, relevance to the everyday world) element of how they convey what their discipline is and what it is about. They do this not just as a pedagogical strategy but because they see the context and relevance of their subjects as relevant to teaching about what the discipline is.

In this chapter too we show that although both history and physics teachers do see their subjects as offering a deep capability or competence to students, they see students' perspectives and willingness to take up their subjects as being impacted negatively by the utilitarian (short-term vocational pay-off) and gaming (maximising the year 12 score) attitudes that are rife in secondary schooling. In their teaching they take the need for student engagement seriously; and also strongly believe that the disciplinary background of the teacher is essential to being able to produce complex knowledge and engagement.

L. Yates et al., *Knowledge at the Crossroads?*
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Curriculum Purposes

There have long been myriad ways of writing about curriculum purposes, some emphasising intrinsic purposes such as enlightenment, development of intellect or creativity and the like, others emphasising more utilitarian directions such as foundations for work and different careers, others again emphasising the values (national, civic, personal) curriculum is expected to instil. Public curriculum frameworks that are established for systems of schooling commonly have elements of all these:

> **Promoting world-class curriculum and assessment**
>
> Curriculum will be designed to develop successful learners, confident and creative individuals and active and informed citizens.
>
> State, Territory and Commonwealth governments will work together with all school sectors to ensure world-class curriculum in Australia. Together the national curriculum and curriculum specified at the State, Territory and local levels will enable every student to develop:
>
> - A solid foundation in knowledge, understanding, skills and values on which further learning and adult life can be built
> - Deep knowledge, understanding, skills and values that will enable advanced learning and an ability to create new ideas and translate them into practical applications
> - General capabilities that underpin flexible and analytical thinking, a capacity to work with others and an ability to move across subject disciplines to develop new expertise.
>
> *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA 2008)

> **Building Australia's future**
>
> Education plays a critical role in shaping the lives of the nation's future citizens. To play this role effectively, the intellectual, personal, social and educational needs of young Australians must be addressed at a time when ideas about the goals of education are changing and will continue to evolve.
>
> *The Shape of the Australian Curriculum* (ACARA 2012)

However, as we noted in a previous review of Australia's recent curriculum history, with curriculum 'the rhetoric is the easy bit' (Yates et al. 2011). Beyond feel-good statements, the more concrete directives of curriculum policies, the testing programs and frameworks they embrace, all embed directions as to what will actually be given priority, and sometimes conflicting perspectives about how knowledge and the purposes of school are to be thought about. In this chapter we revisit the accounts we heard from history and physics teachers about their subjects today from the perspective of two discussions much aired in the research literature about purposes and broader framing of the subject-specific curriculum.

Standards, Benchmarks, Competition

The first lens on curriculum today is concerned with the impact at school and classroom level of the changing form of curriculum policies and management, especially the emphasis on benchmarks and standards and the increased sense of competition between schools and students. As we discussed earlier in Chap. 5 many writers have remarked on the global spread of a number of trends: the interest in measured benchmarks and authoritative international comparisons; adoption of a market philosophy which emphasises competition between schools and students; a concern about a 'knowledge society' and the need for new kinds of outcomes from schools, such as ones more globally oriented to a future flexible worker, distinguished by capacity for 'lifelong learning'. The 21st century has seen a great deal of reworking of curriculum and curriculum policies around the world (Yates and Grumet 2011), and much of this has taken as a point of reference 'the 21st century', looking to skills and capabilities rather than knowledge. At the same time in many countries (and certainly in Australia) these concerns about the changing world and its curriculum implications sit alongside some respect for and desire to retain many of the familiar subjects of the past. Thus the proposed Australian Curriculum developed a framework in which school subjects or learning areas would be retained but would be supplemented by attention to seven 'general capabilities' (literacy, numeracy, ICT, critical and creative thinking, social and personal capability, ethical behaviour and intercultural understanding) as well as three cross-curriculum priority themes. This combination of retaining recognisable traditional subjects but adding greater emphasis on cross-subject skills and capabilities as learning outcomes was already evident in many state curriculum developments in Australia prior to the establishment of ACARA and is also seen in many other national curriculum reformulations (see for example Hogan 2011; Karseth and Sivesind 2010).

So for the teachers we interviewed the curriculum framing of the history and physics subjects is not just what is being said within those specific subject frameworks but also the broader curriculum environment they are now part of. They compete for time and space within the school, and are impacted by the agendas and expectations students and their parents bring to the school. And in Australia, as in other countries, there has been a huge emphasis on testing measures and display of comparative test scores of schools via the government-authorised public *My School* website. Here two key forms of testing are particularly salient, and both pose some issues for history and physics. NAPLAN (the National Assessment Program—Literacy and Numeracy) is a national program testing literacy and numeracy achievement patterns by school at set points through the school career: years 3, 5, 7 and 9. NAPLAN results are given high visibility in the press and on the internet as a broad marker of the standards individual schools are achieving. As the name implies this testing program is based on literacy and numeracy standardised tests, not subject specific knowledge such as history and physics.

Alongside NAPLAN testing which is the only standardised measure of achievement comparison in the earlier phases of school, there is high interest in what happens in the final externally examined (year 12) higher school certificate. This end of high school high stakes examination is used as the main selector for tertiary study entrance. The final examinations and certificates to this date take slightly different forms in different Australian states, but they are transformed via subject weightings into a single tertiary entrance score (Australian Tertiary Admissions Rank—ATAR) which is highly consequential for entrance to within-state universities (and the great majority of Australian students who go to university remain in the state where they undertook their schooling), as well as being used as a national comparative score if needed. (The results of students who have undertaken the International Baccalaureate rather than the local state curriculum are also translated into this ATAR ranking). Queensland has been the exception to this (though under review at time of writing) and instead provides its own completion score known as the Overall Position ranking. Overall school results, and stories about top performing students, are much discussed in the press; and strategies to maximise the final score are the subject of much attention by students and parents as well as schools.

How then are history and physics, these two rather foundational kinds of subjects, faring in the drive of schools and students to demonstrate strong outcomes in the form of numerical test scores?

The Drive for Short-Term Pay-off

During his recent term as Australian Chief Scientist, Professor Ian Chubb spoke at length about his concern about the declining numbers of students taking senior science and university physics.

> Since the 1990s these [student] choices have translated into a decline in the popularity of a major in mathematics, physics and chemistry (the enabling sciences). By 2010, for students enrolled in a BSc [Bachelor of Science] or similar degree, only 13.0% of teaching at the second and third year levels was in mathematics, 10.0% was in chemistry, and 5% was in physics […] important disciplines may be at risk simply because they are not popular right now.
>
> If fewer students enroll in an area, less Commonwealth funding is allocated to it. Less funding means fewer staff (eventually). Fewer staff means less research and less innovation. Less research will mean fewer PhD candidates (the discipline of Statistics as coded by universities is down to fewer than 40 EFTSL). Fewer PhD ***graduates*** will mean fewer staff, and that will mean fewer students and less research and less innovation. And all that adds up to a reduction in capacity – and the trigger was a decline in undergraduate numbers – as they exercise their undisputed right to choose what they want to study.
>
> (Australia's Chief Scientist 2012)

Professor Chubb saw this as a problem of potential decline in Australia's skill capacity:

> We need to ensure that we have the right skill sets in Australia. And we should not expect to be able just to go and buy them when we realise we need them. The 'market' is likely to be fierce in both price and competitiveness.
>
> (Australia's Chief Scientist 2012)

Like others hoping to impact government policies, the Chief Scientist's arguments accept the assumption that education has to be positioned as part of the economic agenda and needs to be justified in those terms. The market, competition for places and resources, measurement and data-tracking are also part of this broad 'commonsense' today about how education is understood. One effect of this is not just that the things that are measured begin to occupy much of the space in the curriculum; and not just that too much time is being spent on things that can be measured, but that students too see the 'measurement by numbers' rather than substantive agendas, as the things they should orient to.

In interviews from the research project, there is some evidence that this is happening in two ways in the senior years of schooling. Students tend to focus on the gaming calculation of advantage (which subject choices maximise the university entrance score), and on the short-term pay-off (the connection between a subject and its immediate rewards, whether that is a particular year 12 score, or is the acquisition of skills that are evidently vocationally relevant). In both cases, at least in the current Australian context, the result seems to be declining numbers of students doing the basic sciences. This market form of understanding education is also seen in a peculiar local discourse in Australia about 'wasting your scores'. Students who do take basic sciences and score highly in them, should 'not waste their scores' by continuing to fields such as basic science that do not require stellar entry scores compared with the prestigious and more highly paid vocational fields of medicine, law and engineering.

Teachers in our project commented on how such philosophies are affecting subject choice:

> Girls are quite strategic in their subject choices and they tend to be looking for advice about academic success more than about foundations of knowledge sort of argument […] It's been quite noticeable here the fact that quite bright girls will make the decision not to do it [physics] because they think they can get a better mark somewhere else.
>
> (Teacher 2: physics)

Another teacher, this time of history, laments students making decisions to drop history because the pay-off in study score will not be as high as they could achieve by taking other combinations:

> They have just brought in a system the last couple of years here where they project the students OP [Queensland's Overall Position ranking] scores based on their achievement so far, to try and make sure students are heading down the correct pathway etcetera. I had two students come to me today in my year twelve history that said "sir we've been told we have to drop a class and do a certificate" or "we should drop a class and do a certificate

> three" so that we can focus more on our maths result to try and boost our OP score and not have another full on academic subject to deal with". That type of thing's kind of pretty frustrating.
>
> (Teacher 32: history)

And a physics teacher makes a similar observation:

> And I had the situation of having two fantastic kids dropping out of physics to do further maths [an easier subject than other mathematics subjects offered in year 12] and I said "well why did you do that?" and they said "we can get a better mark in the further than we can get in physics". The way the marking scheme is set up, it's actually penalising kids that might want to do physics to actually enjoy it, so they're choosing not to do it.
>
> (Teacher 44: physics)

Teachers too will contribute to advice that has a similar effect:

> We get quite a lot of students that want to do medicine. I'd say do Year 11 [physics], which is school-based, so we can put in the stuff which will be of interest and use to the students, and then when you do Year 12, do something else. Health and human development will get you a higher mark than physics. If you want to do medicine, then do that to get a higher mark. You will enjoy it more.
>
> (Teacher 27: physics)

Note that these are observations by teachers and represent views (possibly urban myths) circulating among students, teachers and parents, rather than being necessarily accurate accounts of how subject scoring and weighting operates. Curriculum authorities give a great deal of technical attention to how to weight study scores from different subjects with the object of trying to avoid advantage or disadvantage as an artefact of subject choice—though there is no way to do such an exercise perfectly. But what they particularly show is that an orientation to the test score impacts on how students see subjects and the purposes of studying them, and in some ways whether students take up particular subjects.

The Chief Scientist's solution is to make the usefulness of science more evident, but to some extent the utilitarian focus on external visible usefulness (another form of valuing short-term pay-off) may be part of the problem. Another physics teacher says this:

> Everything is driven by careers. And there's this overwhelming— even my best students, you know— I was talking to some of them, they go, "Oh, I want to do commerce". And I'm going, "Why commerce? Why?". And it's all driven by money and if that's the case then where is physics or science education? Until that's rectified and there is a change in the thinking about what education is, especially at university level, well that's just turning into "just pump out people for job factories". Until that changes, I think all these hard sciences are going to find it really difficult to recruit the best people and there's some good people out there who should be doing that sort of stuff and aren't […] Their thinking is well, I'm driven by cash and I need to have money so I can live, and I have this expectation and so on and so on so. […] Post-war, heaps of people were doing sciences because (a) it was interesting and (b) the wage disparity wasn't as huge between science and other workplaces, but that's just changed, you know. You can become a gambler and call yourself a derivatives trader and make a hell of a lot more money.
>
> (Teacher 5: physics)

In this respect, the taking up of a global competitive agenda about economic capacity produces some short-term focus on pay-off that may undermine the longer-term contribution that these subjects offer. Similar issues have been raised in relation to higher education, for example in a discussion about Stanford University in the USA, known for its outward looking orientation to entrepreneurial activities (Auletta 2012).

Schools and teachers then are caught up in strategic concerns to maximise scores on the things that get measured. Teachers spoke about the ways this can interfere with their aim of drawing students into the subject and having them develop a passion and interest for it:

> Some of the younger teachers, yes, some of the younger teachers coming in think this is what teaching is. Teaching is the mark that a kid gets in a test or the mark they get in a NAPLAN. We have it here you know: they look at our HSC results, how many B and C's we get. We've got the *My School* website where we rank the schools.
>
> (Teacher 12: physics)

> And "is this going to be in our exam?", is what my juniors ask me; "what do we have to study?" is what they ask, and the seniors always ask "what's the point?", "why do I have to do it, I'm never going to write a research task again?". They've lost the sense of […] and I think that's partly our subject area's fault for putting emphasis on things — that they are not seeing quality or worth in [history] and I think it's obviously also higher than just schools and government agencies that are sending that message.
>
> (Teacher 52: history)

Other teachers speak of the effect the pressure to maximise the examination score has on the teaching of the subject:

> All VCE [Victorian Certificate of Education] subjects are time-poor and content-heavy. Because the reality is that they need a good mark and you'll be remiss if you didn't make sure that they were prepared for the exam. We always structure the Year 11 course to parallel the Year 12 course pretty much straight out.

She goes on to say:

> There is quite a lot of chalk and talk in the VCE because there is just not time to do anything else.

And later comments that:

> We teach them to compartmentalise their knowledge and that's what they do… And we teach them to aim for an assessment task and that's what they do. And then they stop thinking about that and start thinking about something else
>
> (Teacher 2: physics)

In Chaps. 3 and 6 we discussed how there was a difference in rationale for the study of history between statements being made by government and at policy level, which gave an emphasis to content and values via the story of history; and views of teachers we talked to, who gave most emphasis to the skills of doing history. In this context, a teacher at an academically selective school in the state system, whose students were highly successful in gaining good final results,

commented that such attention to the end point could affect not just the choice of subjects, or the cramming of content, but produce an explicit attempt to guess what an examiner would value. In his view that distorted the taking up of the subject:

> But we set a question about the ANZAC spirit and it was from a quote by Paul Keating, where he was talking about the ANZAC spirit and the meaning of that. And 90% of the essays that I got in, such as they were, were very much taking the patriotic line and celebrating the ANZAC spirit, uncritically. I was a bit horrified because I've only had this class for the last term but we've been looking at some quite, I suppose negative sides of the First World War […] It's not that the students I think didn't understand that, I think it was more the expectation that they felt once they were in a formal exam situation, there's some sort of line that you have to toe. That was the sense that I got anyway.
>
> (Teacher 8: history)

'Powerful' Knowledge and 'Everyday' Knowledge

The second lens we take up in this chapter relates to discussions in the curriculum literature about knowledge. Here we are considering some of the broad rationales for curriculum framing overall, rather than the subject-specific cases which each subject makes about its own value, and particularly the arguments that make a case for the distinctive type of knowledge that can be generated by subjects often tagged as 'academic' ones. The arguments discussed earlier in the last section of Chap. 2 made the case that to see the purpose of schools in narrowly utilitarian purposes (whether social or vocational) undervalues the kind of intellectual development of students that is the specific role of formal education, and exaggerates the extent to which schools can create social and economic transformation, for example in overcoming inequalities. Rather, they argued, schools have a distinctive role to introduce students to forms of knowledge that are in principle different from informal social learning (including internet learning) and that will give them capacities they would not simply develop through their everyday life—greater powers of abstraction for example. To gain the benefit of powerful knowledge, students need to gain a sense of the subject as a form of knowledge, not just acquire bits and pieces associated with it.

> [Powerful knowledge] is differentiated from the experiences that pupils bring to school or older learners bring to college or university. This differentiation is expressed in the conceptual boundaries between school and everyday knowledge.
>
> (Young 2013, 109)

> From 'the sacred' tradition, [curriculum] must take not only the idea of a 'store of knowledge' but those peculiarly human values of inwardness and inner dedication that shape and are associated with disciplined study and enquiry.
>
> (Young 2013, 103)

> The difference between school knowledge (in other words, the curriculum) and everyday knowledge is that they are constituted by concepts that are different in both structure and purpose. The everyday concepts that children acquire in growing up enable them to make sense of the world in relation to specific contexts. They are context-specific but are flexible and endlessly adaptable to new contexts and new experiences. […] In contrast, the concepts associated with a subject-based curriculum are not tied to specific contexts; they are linked to each other and the underlying theories associated with the subject in question and underpinned by the community of subject specialists. It is this difference in structure that enables students with access to subject-based concepts to generalise beyond their experience and provides the educational rationale for the curriculum and its links to the broader purposes of schooling.
>
> (Young 2013, 110)

These kinds of arguments acknowledge that teachers pedagogically need to take account of the experiences of students and may use everyday examples for this purpose, but they draw a sharp distinction between two ways of framing the curriculum agenda—one which looks primarily outwards to the world of everyday knowledge and short-term utilitarian purposes, and another which looks inward to understanding and developing the distinct concepts and structure of the discipline or its cognate subject, drawing students into the dispositions and ways of thinking of the subject itself. It is the latter that is seen as building foundations for more powerful conceptual work in life beyond school, whatever specific vocational directions students take.

A previous variant of these arguments was developed by the sociologist and curriculum theorist Basil Bernstein in the 1970s in an argument that is arguably one of the greatest contributions to theorising of curriculum forms and their effects. In that article, 'On the classification and framing of education knowledge', Bernstein (1971) analysed two forms of curriculum structure, ideal types but broadly evident in the schooling systems of different countries and in debates at the time between 'progressive' and 'traditional' approaches to curriculum in the UK. One form of curriculum is broadly hierarchical in form and based on separate subjects, largely traditional ones. At its base (primary and secondary school) students study a lot of different subjects, then in senior secondary school and university continue with more extensive study in a smaller range of subjects. The second pattern takes the form of a curriculum organised around themes or problems or topics rather than existing subjects. Here different kinds of subject knowledge or disciplinary approaches may be drawn on, but with a focus on the integrating theme or problem rather than the development of the subject.

Bernstein called the structure organised around separate subjects a 'collection code'—that is it consists of separate subjects with quite strong boundaries between them, and quite strong definitions derived from the subject itself (rather than the student) of what counts as appropriate knowledge for that subject (for example in the classroom, or in examinations). In this curriculum structure, Bernstein argued, the form of entry into the subject knowledge was strongly hierarchical—in formal curriculum terms students have limited power at the school level compared with the authority of the subject and of the teacher, but students

who continued in particular subjects over time develop a strong subject identity (became an insider of the subject) and acquire its specialist boundaries and ways of seeing as a foundation for more openness and disruption at the doctoral phase, by which time they would see its inner secrets and problems. (This has some resonance with Thomas Kuhn's work on scientific paradigms and the breakthroughs they enable by first learning to thoroughly work with the assumptions of a field at a particular time until the sticking points and need for a new perspective become apparent.) At the same time, while there is openness and some ability to create new knowledge at the research phase, the induction involved in acquiring disciplinary identity also has a conservative element.

In the second approach, most familiar at the primary school stage, but regaining popularity in more recent times with curriculum framed in terms of competencies or attributes or capabilities, the overarching framework is provided by what Bernstein calls the 'integrating idea', and he named this curriculum pattern an 'integration code'. Here students in formal terms have more power to decide what is relevant to the chosen theme and to bring more of their everyday knowledge into school contexts, or the curriculum may have a broad inquiry-based form steered by the teacher. There is in principle more openness as to what is appropriate knowledge in relation to that subject or theme. However, Bernstein argues, although students may be drawn into a form of knowledge creation in relation to the topic or theme at hand, the learning is necessarily tied to and limited by the integrating theme. It requires some consensus by the group or group of teachers about that integrating theme in comparison to subjects which have their own history (authority drawn from outside the classroom interchange) and some in principle future openness. That is this form of integrated teaching has a short-term liveliness but draws on and is limited by the present.

In comparing two ideal type education structures, Bernstein drew attention to different exchanges of power and authority, different forms of identity-making, but also different forms of openness and ability to generate new knowledge beyond the existing stage of learning. He suggested some of the potential of a discipline-framed curriculum, but particularly for those students who continued to the higher levels. He suggested some of the openness of a more student-focused integrated curriculum and its ability to engage students from more disadvantaged backgrounds—but also at some possible expense in terms of a longer-term education trajectory. Some of the resonances of these arguments can be seen in discussions about foundations for interdisciplinary research, which we discuss further in later chapters. In the education literature, Teese's (2000, 2014) work on patterns of subject choice relative to social class shows some empirical support to the hierarchies and identity relationships Bernstein associated with the different forms: in the sciences, the more abstract the subject focus, the more the student intake is skewed to higher socio-economic levels.

So how do the history and physics teachers themselves understand the value or power of their respective subjects? Do they draw a sharp distinction between the everyday world and learning what it is to do history or physics, to turn inwards to those subjects and their forms and preoccupations?

One of the things we were interested in when we asked history and physics teachers about what they thought mattered, and what they hoped students would take from their subjects, was what kind of emphasis they gave to drawing students into the subject, a kind of inward-looking purpose about that form of knowledge, as compared with the extent to which they saw their purpose in more generic or utilitarian terms. What we found is that these teachers did in many respect echo the kinds of arguments quoted above about wanting students to learn to understand and respect the subject conceptually, as a distinct form of knowledge.

Teachers would provide justifications for their subject in practical or utilitarian terms (skills or knowledge students could use in the world, or later in jobs), but they often commented that they saw the induction into the subject itself (for example the critical reading of documents students learned in history, or the experimental methods students were introduced to in science) as having a greater depth than teaching such skills directly in the form of 'communication skills' or 'problem-solving'. At the same time, in aiming to draw students into their subject, teachers were very aware of and sensitive to the need to engage students, and of things that might work against this—content overload, over-emphasis on testing, topic selection.

Both with history and physics, teachers wanted students to see something of the scope and distinctive approach of their subject, its technical methods and its broad possibilities.

> I don't like to see checklists of skills […] I hope they do take some skills away from the subject that they've learnt along the way. But I think none of that's valuable unless they do have some sort of—a personal fascination with it, and some kind of passionate interest that comes out of it […] If you're not interested in it, but they have great research skills or you know, whatever it is, then that might be valuable but it's not teaching history I think. So that special kind of interest in the past and the understanding of how their own lives connect with the past—I'd want that to come out of it, I think, and if they haven't got that, then we've failed.
>
> (Teacher 8: history)

> I always remember Bob Carr, who was Premier of New South Wales and a great supporter of history, he was speaking at one of our presentations once and spoke very passionately about history and said he wished that more of his public servants had history training because they didn't seem to have the ability to put a brief together or to give him advice in a way that was coherent and useful. And he suggested that that sort of training, how you get that sort of ability, that's the sort of training that comes with dealing with history in a theoretical setting and then it moves over to give you those practical, vocational skills.
>
> (Teacher 9: history)

Physics teachers put great emphasis on wanting students to be interested in the kinds of questions physics deals with, to be excited about big issues, to appreciate what physics does. As we discussed in the previous chapter, one of the things they were grappling with in response to a new physics curriculum framework was precisely how best to produce this kind of 'insiderness' and interest in the kinds of questions and approaches physics takes up—how to achieve the balance between gaining foundational tools and background in mathematics, knowing about earlier

physics discoveries, and also gaining some hands-on experience of the excitement and rigour of experimentation and of the big questions physics is involved in today.

> I think it is characterized by just the thirst to understand how the world works and in that sense it's […] sort of overriding of the sciences, in a way, of the hard sciences […]. So if you understand the physics, the chemistry flows. So does the biology. I mean you can't from first principles work out all of that stuff but it's a good way to start and I'm always fascinated by the—and you know, intrigued by the fundamental basis of what goes on.
>
> (Teacher 5: physics)

> For most of them I hope they just come away with a bit of wonder and awe, you know, because physics is that big thinking stuff and one of the disappointing things about the new National Curriculum which was just released is there's no astrophysics or astronomy. And in the Victorian Curriculum we have both astrophysics and astronomy and both of those are the big picture wonder and awe, you know, part content. And I mean, they're elective, you don't have to choose them, but a lot of schools are doing either one or the other because it's one of those things that the kids just love, they really lap it up and they're really interested in it and are excited by it, because it is these crazy big questions that we don't know all the answers to. I love the fact that I can say to them, "I don't know the answer to this, and perhaps you'll go away and find out for me and come back and tell me and when you're in your PhD or when you win your Nobel Prize I hope I get a mention in the speech."
>
> (Teacher 22: physics)

> It's very quantitative, it's very about measurement, very much. It has a very rich history, I think, a very exciting history and that's part of the fun of teaching it. It has an incredibly wide allocation and it's so fundamental to so many things in society and so many other academic disciplines. […] I teach science and I teach physics for lots of good reasons, but partly because I'm a physics teacher, and because I should be selling it I think, on the first day I say "you're really lucky because you are going to learn about the greatest intellectual achievement in our species." And I talk about what physics has achieved.
>
> (Teacher 13: physics)

Another teacher talked about the fact that she not only wants students to do some basic physics in the junior science curriculum, but she wants them to learn to name that as physics, to have a sense of what physics as a field does, not just to do it.

One of the things much discussed in relation to the earlier arguments in favour of 'academic' subjects as powerful knowledge, especially by sociologists, is the tension this often produces in practice in relation to reproducing inequalities of various kinds. Within the physics community, many of those we interviewed spoke passionately about the value and power of the subject as a fundamental one but they also are clear that they do not expect all students to achieve extensive expertise in the subject. In physics, its difficulty and eliteness is part of its central identity. There are differing views among the teachers we interviewed about the implications of this tension. Some use the eliteness as a selling point. Some see it as over-emphasized by science teachers who have not themselves trained in physics, and unnecessarily off-putting to students. Some disparage the inclusion of a greater emphasis on social perspectives on physics as part of a drive for student inclusiveness at the expense of 'not teaching physics'—while others see that kind of balancing of mathematical foundations and experiment and a broader sense of

the achievements and awe of the subject as important in drawing students into what physics 'is'. And some are more explicit that they think about the need to balance 'physics for all' and the needs of specialist knowledge-building in physics, that is, the physicists of the future. This was also a concern for many of the physics academics that we interviewed, and they often held strong opinions about what school physics should be doing:

> There's also the fact that a lot of students don't actually like physics and if you want to attract those students, you—best thing to do is teach them something that isn't physics, and so there's a pressure in that direction […] I don't know how many ought to be attracted to physics. I think that physics should be taught in two different ways. I think that virtually all students should do a general background in science. Those that study physics at the senior high school level should be a minority, because there are lots of other things to study and a lot of people don't like physics, however, that minority supplies our engineers, scientists and technologists so it's a very important minority, and therefore [worth] working for. It's an elite and I admit to being elitist but then it's a very important elite and we want to keep them elite and make them more elite […] There should be a very good quality physics, where people learn physics in senior high school, and there should also be perhaps a general science course where people learn a lot about different sciences and how they interact with social problems.
>
> (Academic 22: physics, Go8)

History teachers, as we saw in Chap. 6, also placed a lot of emphasis on students learning methods they see as core to history as a discipline—especially learning to work with and distinguish primary and secondary sources, attend to context, construct coherent accounts and defend the construction of arguments and interpretations in relation to evidence. They defend the value of systematically studying history, as a way of educating students in these skills and understandings, but their accounts do not emphasise a sharp distinction between the modes of their subject and everyday or more utilitarian purposes:

> I hope they take away that sort of rationality, that ability to transfer the skills of investigative inquiry to other fields including medicine, to take away [a] time perspective to apply to medicine.
>
> (Teacher 17: history)

> I want my students in my Year 12 history class, as I said before, to be critically literate citizens. I want them to be able to look at a source and not take what it says at face value. I'd like them to actually question the material they read. I assume that that's a skill that they will need to carry over into university.
>
> (Teacher 20: history)

Conclusion

In the two previous chapters we looked at how teachers in physics and history discussed how they saw their subject and how they thought about what was important in it. In this chapter we revisited the interview data, this time related to theories and arguments about what is important about disciplinary knowledge. We took this up in two ways.

First, in relation to broad arguments about the impact of testing and neo-liberal thinking, we considered what these teachers said about how this mind-set can affect subjects at the school level. They saw the effects particularly in students' thinking about subject selection in the senior school, and to some extent in how students approached subjects—in terms of an increased calculation of pay-off and utilitarian attitude. Although it is of course entirely reasonable and common for students, families and parents to be concerned about high stakes testing and the kinds of future work and university options that get opened up or cut off by achieving or failing to achieve particular scores, to look at subjects primarily through this short-term use value may do particular harm to the kinds of subjects physics and history represent.

Secondly, the curriculum theories we considered maintained that the power of discipline-based subjects lies in their disciplinarity—that students need to be drawn into this rather than just drawing on history or physics to address problems or relevant themes. Teachers we interviewed did similarly see this kind of induction into the discipline as important. They wanted students to see the ways physics and history defined their objects of inquiry and the kinds of methods they used. This was reflected in the emphasis history teachers gave to developing historical methods of inquiry and writing; and in the way physics teachers wanted to include both some hands on experience of experiments and also some broad sense of contemporary physics research. But the teachers did not draw a sharp binary between learning about the subject, and drawing connections to worldly experiences and later relevance. To draw students into disciplinary 'insiderness', they understand the need to connect with students and their interests, to engage them. Without it, they are aware that a curriculum framework on paper can achieve little. But they feel the extrinsic discourse that looks for hard-headed economic benefit at every turn (or values/social integration pay-off in the case of history) can make it harder to draw students into the excitement of the forms of learning themselves.

References

ACARA (Australian Curriculum Assessment and Reporting Authority). (2012). *The shape of the Australian curriculum*, version 4. Retrieved from http://www.acara.edu.au/verve/_resources/the_shape_of_the_australian_curriculum_v4.pdf

Auletta, K. (2012). Get rich u. *The New Yorker*, 38–47.

Australia's Chief Scientist. (2012). *Address to the National Press Club*, Barton, ACT, 23 May. Retrieved from http://www.chiefscientist.gov.au/wp-content/uploads/Australias-Chief-Scientist-address-to-the-NPC-FINAL-23052012.pdf

Bernstein, B. (1971). On the classification and framing of educational knowledge. In M. F. D. Young (Ed.), *Knowledge and control: New directions for the sociology of education*. London: Collier Macmillan.

Hogan, D. (2011). Whither a city on a hill? Globalization, quality and equity in US schools. *Discourse, 32*(3), 457–474.

Karseth, B., & Sivesind, K. (2010). Conceptualizing curriculum knowledge—within and beyond the national. *European Journal of Education, 45*(1), 107–124.

MCEETYA (Ministerial Council on Education, Employment, Training and Youth Affairs). (2008). *Melbourne declaration on educational goals for young Australians*. Retrieved from http://www.curriculum.edu.au/verve/_resources/National_Declaration_on_the_Educational_Goals_for_Young_Australians.pdf

Teese, R. (2000). *Academic success and social power: Examinations and inequality*. Carlton, VIC: Melbourne University Press.

Teese, R. (2014). *For the common weal: The public high school in Victoria 1910–2010*. North Melbourne: Australian Scholarly Publishing.

Young, M. (2013). Overcoming the crisis in curriculum theory: A knowledge-based approach. *Journal of Curriculum Studies, 45*(2), 101–118.

Yates, L., Collins, C., & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: State cultures and the big issues*. Carlton, VIC: Melbourne University Press.

Yates, L., & Grumet, M. (Eds.). (2011). *Curriculum in today's world: Configuring knowledge, identities, work and politics*. New York: Routledge.

Part IV
Universities

Chapter 9
'What Does Your Discipline Look Like and How Does It Matter?' Historians and Physicists Talk

In the sociological literature on universities, history and physics are shown as having some commonalities as disciplinary fields, but also many elements in which they are depicted as opposites in relation to knowledge practices and knowledge building. In Becher's (1989) terms both are 'pure' rather than 'applied' disciplines. (This does not mean that they are not involved in applied purposes or collaborations but that the purposes, problems and methods central to each as a discipline relate to their core focus or problems rather than extrinsic purposes). Both too have similarities in relation to their long histories of being a visible component and presence in universities, in having well-established organisation as professional associations, and in their use of academic journals, conferences and peer review mechanisms. On the other hand, they are often presented almost as archetypal oppositions or binaries in relation to different forms of knowledge and disciplinarity. Becher (1989) and Muller (2009), for example, contrast the 'hard' and 'vertical' knowledge of the physical sciences, where a strong degree of paradigmatic consensus exists, with the 'soft' and 'horizontal' knowledge of the social sciences, where there is less agreement around or commitment to a common body of theory. Similarly in Maton's (2009) framework, physics is represented as a field governed by judgement of 'knowledge' claims (the knowledge claim rather than the status of the researcher is central) compared with history which he sees as a field governed by judgement of 'knower' claims (the status or reputation of the one who speaks is important to how accounts are judged). How well do these kinds of typologies and claims stand up in the world of Australian physicists and historians today? How do historians and physicists describe their respective fields and its changes? Is the changing world of universities impacting similarly or differently on them? How do they think about the forms of education and of research in relation to the knowledge-building agendas of their particular discipline?

In this chapter we draw on interviews carried out with Australian historians and physicists about such questions. As outlined in Chap. 1 and the Appendix, we

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interviewed people of different ages and gender, of different career stages, working in different kinds of institutional context. In this chapter our focus is particularly on the specific ways they see the knowledge and knowledge forms of their discipline or disciplinary field, and the implications of this for the education and research mission of universities. In subsequent chapters we will look in more detail at two other aspects of these fields in the changing environment: how our interviewees are positioned in the drives for new forms of interdisciplinarity and 'graduate capabilities'; and the impact on them of new forms of managing and auditing the work of universities and those who work in them. These issues will be touched on briefly here as part of the story of the two disciplines, but in more detail in the two chapters that follow.

Historians and Physicists on their Disciplines

In the interviews we began by asking about the interviewees' own background and studies and about whether they see themselves as a historian or physicist. Issues of identification are relevant to a number of arguments about academic knowledge creation and about interdisciplinarity. Arguments by theorists such as Bernstein (1996) would see not just the acquisition of knowledge but becoming an insider to a discipline as an important pre-requisite for the ability to break existing boundaries and create new knowledge at the doctoral level or in interdisciplinary collaboration.

We then asked these university academics to talk about what they see as the key characteristics of their discipline and about whether this has changed. Following that we asked a series of questions about their actual teaching and research activities, including their purposes and what impacts on these and including their perspectives on what is needed in their discipline at school level compared with undergraduate studies and compared with research training. Later questions in each interview relate more specifically to interdisciplinary imperatives and assessment and performance measures and will be discussed in the following chapters. (The full interview protocols are set out in the Appendix of this book.)

'***Would you consider yourself to be a historian/physicist?' 'Do you think of history/physics as a distinct field of study or discipline?' 'If you do, what do you think characterises it?***'

Whatever their current actual organisational location and work profile almost all physicists and historians we interviewed exhibited strong identity with their discipline—explicit as well as tacit identifications (the very few exceptions will be discussed a little later). Both groups also made reference to the proliferation and changing form of their disciplinary field over time. However, there is a striking difference in how physicists and historians responded to the questions about what characterises their discipline.

The physicists responded to the question of what constitutes their discipline with ease, and as if reading from a common script—'fundamental', 'core', 'mathematical', 'stripping a problem to its essentials'. Physicists see physics as a fundamental and foundational form of knowledge that describes how the physical world works; it describes 'the laws of nature at their most fundamental level'. Many saw their interest in physics as stemming from a desire to understand how the world works, often from a young age. Core to the discipline is a particular form of 'stripping a problem to its fundamentals'. Many spoke of the ability to take this way of looking at the world to explore a much broader set of problems. The physicists we interviewed showed pride in the history of physics and the innovations it has contributed to in everyday life, as well as in the fact that it deals with the really big 'nature of the universe' questions. They saw it as an 'enabling science', one that has underpinned many technological advances, such as the development of the MRI and solar panel, but also as one that can contribute to the other sciences in providing a particular kind of abstracted and mathematical understanding. Many identified the use of mathematics in the discipline as the major point of differentiation of physics from the other sciences:

> …addressing fairly fundamental problems in fundamental understanding of the universe but also I guess fundamental problems that affect the world in general.
>
> (Academic 1: physics, Go8)

> We're exploring the laws of nature at their most fundamental level. The level of elementary particles and fundamental interactions. And we're trying to do that in as mathematically precise way as possible…
>
> (Academic 12: physics, Go8)

> Physicists have to be mathematicians because the universe works by mathematical rules.
>
> (Academic 3: physics, Go8)

> I feel engineering is more applications based and they are not worried about the why if something happens, they're more worried about if it works in an application, I think. Whereas physics is the fundamental understanding of how something works.
>
> (Academic 52: physics, Go8)

At the undergraduate level, physics continues to be viewed by physicists as a 'vertical' discipline. Physics at this level was described as 'hierarchical', 'sequential', 'technical' and 'content focused'. Much of the content is viewed as firmly bedded down and there is believed to be a core understanding of physics and mathematics required to complete a major in physics. The areas discussed as core to the discipline at this level are mechanics, quantum physics, electromagnetism, relativity, thermal and statistical physics. These were seen as of particular importance when training future physicists in that they provided the foundational knowledge required to understand the discipline. (As we discuss in the next chapter, although many physicists are involved in interdisciplinary research, and a number had experience of setting up or teaching in courses defined as 'nanotechnology' rather than 'physics', there was a large amount of consensus on the value of seeing

the discipline of physics as the core foundation). For those students who will not be going on to pursue a career as a physicist, a more general sense of what the discipline has to offer was believed to be important.

At the same time as interviewees expressed a sense of a largely agreed upon core for undergraduate physics, they also commented on a knowledge explosion occuring inside physics as well as outside it. Many of those interviewed mentioned that where once it had been possible to cover the whole of physics at the undergraduate level this was no longer the case. This in turn poses issues for the specialist content development needed for the honours phase (in Australia the fourth and specialist year of a Bachelors degree) and doctoral work.

Although some of the physicists we interviewed had been innovative in developing new subjects and ways of teaching, whatever their status and department location, the physicists gave priority to physics research, and clearly saw teaching as directly derived from this.

> If you asked most of the academic staff here who teach, what are the attributes in terms of education, teaching and learning they wouldn't know what you're talking about. Because they are just teaching physics, that's how they see it […] So these are very good high quality researchers who also teach. That's how we see ourselves.
>
> (Academic 18: physics, Go8)

To our question about identifying as a physicist, one interviewee who had an unusually large responsibility for teaching and physics education in his department said this:

> Some days yes, some days no. (laughs) It's an interesting thing. I think I can sort of turn it on and off a bit. Whereas you see, some other physicists who are almost distracted every time they notice something new or they always have to be sort of, looking at new research in physics, whereas I am interested in keeping up with that, but not committed to it all the time. And I think intellectually I find it more challenging to think about how students develop rather than how science develops.
>
> (Academic 36: physics, Go8)

This interviewee, who saw himself as a teaching specialist, was the only one of our university physics trained cohort to hesitate at all about identifying primarily as a physicist, even though a number of those we interviewed were not working in specialist physics departments.

At the research level, the requirement for deep specialisation was discussed to the extent that one Head of Department described how he now has trouble understanding all his departmental seminars. The discipline as a whole was discussed both in terms of 'starting to touch on the limits of where physics starts hitting against other subjects a little bit' (Academic 23: physics, Go8) and in the complexity of the problems that are now being researched and that require collaborations with other specialisations both within physics and in other fields. In terms of changes of the field, biophysics is one area nominated as developing towards becoming a recognised new field—involving engineering as well as medicine and the biological sciences. Physics academics felt that there is now more collaboration with other disciplines compared to in the past.

So the physicists spoke easily and clearly about what distinctively identifies their discipline, they reiterate perspectives described in previous literature as 'pure', 'hard', 'vertical', but they also touch on issues of the proliferation of the field and increasing specialisation within it, and the implications of these for adequate structuring of the undergraduate curriculum that we will return to later.

The historians we interviewed also often spoke passionately about their subject, about 'falling in love with history', and about history being a way of seeing the world that makes sense to them. They strongly believed that their subject was important both as a field of important knowledge about the world and as an important form of disciplined inquiry or intellectual foundation for operating in the world. However, when asked, they often struggled to define their discipline and did not have a ready answer that captured history as a field. Some talked about history as being defined by time and place or about understanding a particular aspect of the past but these were not consistently mentioned. Many chose to respond to this question by talking about the way historians work with evidence, and the kinds of accounts they produce. They acknowledged that history is hard to define: one interviewee (Academic 11: history, non Go8) commented that 'history has a strong identity but blurry borders'; another (Academic 20: history, Go8) that 'history is distinct and open at the same time'. Yet they clearly also had a strong sense that history does have a distinctive quality and power in that texture of working with evidence, context, arguments, critical judgement and the like, reaffirming Becher's (1989, 264) findings that the discipline of history is characterised by 'internal unity and external openness' (discussed in further detail in Chap. 3).

Here are some of the responses by historians to this question of what characterises history, and you can see in these the differences of emphasis in relation to such matters as theory and empirical work, and the struggle to articulate the methodological grappling with complexity and rigour alongside acceptance of the legitimacy of different perspectives:

> The fine attention to detail of documentation, contextualisation. Which is hugely important…And I think reading documents, contextualisation, developing arguments, developing a logic substantiating those with evidence, those sorts of skills, I mean sure, other disciplines do them but I think there are aspects to those that history particularly encourages.
>
> (Academic 2: history, Go8)

> I guess for me history is about incorporating numerous different theories and methods and tools. And it's about reflecting on—the point of history is to put things in their context, I guess, to understand that things come out of a particular time and place. I think to do that you need to have a sense of a story, so you need to have some sort of archive.
>
> (Academic 5: history, Go8)

> One of the things I've always liked about history, I suppose going right back, is how much you can do within this—you know, how porous the boundaries really are and as long as it's about the past, which almost everything is, you know, it's really a very catholic discipline.
>
> (Academic 8: history, Go8)

History is distinct and open at the same time. You should be able to write for a wider public, otherwise you are not really succeeding as a historian.

(Academic 20: history, Go8)

Historians have to gather evidence to make arguments, right? To make arguments about the past based on evidence.

(Academic 21: history, Go8)

I certainly don't consider myself a post-modernist in any stretch of the term, but I do like the idea that history is firmly rooted in debate but this is all based on informed opinion and interpretation.

(Academic 26: history, non Go8)

Well in its simplest form it's a discipline which seeks to interpret the past and often in times interpret the present through the perspective of what's happened before. It's a discipline that looks in a quite detailed way into the human experience, the human condition.

(Academic 29: history, non Go8)

I'm very old school in that respect, as far as history is concerned I'm no believer of theoretical models, abstract concepts, post-modernist, cultural relativism. I see history pretty much as a forensic science, where you only have the smoking gun for example, and it's up to you to collect the evidence to reconstruct what happened in the first place, and in the second phase you try to explain, try to produce a narrative of how come.

(Academic 34: history, Go8)

There's no single methodology […] it's a whole set of methodologies, depending on what type of historian you are, that you will draw upon and use, which will include an awareness of sources and source criticism and it will be awareness of how you use and work with archives, it will be an awareness to what extent, how do you understand and use the traces of the past that are available in the present. And then there's stuff that people actually don't talk about a lot but how do you actually amass and use vast amounts of data and draw out your own conclusions and arguments and narratives and stuff from that.

(Academic 35: history, Go8)

[H]istory is quite a plural discipline, historians can employ almost any kind of methodology, archaeology, economics, cultural theory and so on, but there is a distinct sense of looking about change over time. And you articulate your methodology however you want to. […]. The way we structure our writing makes it history.

(Academic 47: history, non Go8)

I think the thing that characterises it is an attempt to make sense of the human past by the critical use of evidence. So at one level I hold on to the empirical basis of the history discipline which obviously is epistemologically more complex now than it used to be. But I do think that history has an advantage in that it deals with topics and tells stories that broader public is interested in and that the broader public finds essential to making sense of our society and our culture and politics. […] We shouldn't be embarrassed about the fact that we use evidence the same way that an engineer uses evidence to decide if a bridge is going to stand up or a surgeon uses evidence to decide if a procedure is effective. Well I think that historians using historical evidence to draw conclusions is a process that does have credibility in the larger scheme because there is some bashfulness about the fact that we remain empirical rather than overly theorised in our conceptions of the past.

(Academic 49: history, Go8)

Physicists sometimes drew on comparisons with engineering and chemistry to illustrate what was distinctive in their own discipline's approach to cognate areas. Historians did similarly, and here the elements that were marked out in various comparisons included:

- that history takes a more comprehensive or contextually situated approach than other related subjects, for example:

> [As a result of] the historicist turn in literature for example there are certainly people in English… doing very historical studies. I suppose to us they look—there are still some differences. They're no longer only reading canonical literary texts, they're reading a much wider array of things but there's still a closer reading of a smaller number of texts I suppose, as opposed to the best history which aims to—even though we know the goal of total history is impossible, there's still this ideal of exhaustiveness that you try to read everything that you can.
>
> (Academic 8: history, Go8)

- history's attention to specificity and context in comparison with models or universal theories:

> A lot of political scientists pretend to teach history and foreign policy, which they don't – they are just teaching theory and stuff like that.
>
> (Academic 24: history, non Go8)

> International Relations […] will draw on history to use as case studies, to determine whether their theory works or not you know, that sort of thing, and perhaps even predict what may happen in the future by drawing on past examples and what not with political science or something like that. So in that way historical events are used as a tool or instrument, just to be used as a case study for other purposes, whereas for us it's the actual study of the past.
>
> (Academic 26: history, non G08)

> I don't think a lot of other disciplines have that kind of specificity, interest in specificity. You know there's a lot of cross over between politics scholars and historians but I think they're often looking at universal themes or ideas or characteristics in ways that historians probably wouldn't be so interested in.
>
> (Academic 50: history, Go8)

> I think history is kind of resistant to a lot of theorising and I think that's one of its strengths as a discipline because ultimately we're talking about human beings and what people actually did and what people actually experienced.
>
> (Academic 45: history, non Go8)

- methodologically and in writing displaying a somewhat tacit yet distinctive approach to producing an account:

> I definitely do think it's its own discipline, [although] we don't have founding theoretical figures in a way that say sociology does. But in some sense I think that it's clearer to most people what a historical mentality is as opposed to a sociological mentality […] But yes I don't think it's defined as it has been because of certain founding fathers, unlike psychology say, but more for a particular approach to scholarship.
>
> (Academic 44: history, non Go8)

> …probably historians are less methodologically explicit than a lot of other disciplines
>
> (Academic 35: history, Go8)

> [H]istory is evidence-based, and you have to work primarily from archival sources and sources you can cite, […] rather than coming up with grand theories and all those sort of ideas.
>
> (Academic 37: history, non Go8)

Of course, as many also made clear there is a considerable spectrum of historical work and strong debates or contending schools within the field, some of which are highly engaged with theory. But there was a strong sense that the kinds of accounts (or knowledge) historians aim to produce, values the specificity of experience and values care in seeking and deploying evidence, in ways that they see as different from related areas of the humanities or social sciences they also engage with. Working with evidence, making arguments, some eclecticism about theory and drawing in other disciplinary knowledge as part of the approach are all part of this.

So historians do strongly identify as historians, and have a strong sense of their discipline, but convey this discursively rather than in a neat definition. This, we will suggest, is likely to serve them less well in two contexts we discuss later—making the case for the specific needs of their discipline in relation to the performance measurement agendas of contemporary universities, and in relation to reforms of undergraduate curriculum which reduce the numbers of history subjects that can be offered.

Finally, there is the issue of identity and the discipline. As we discuss elsewhere, the funding pressure on Australian universities combined with their concern about research rankings has led to a greater split than previously between a smaller number of tenured research and teaching positions whose occupants are expected to be more highly productive in research, and a much larger number of casualised appointments paid by the hour to do teaching. A number of historians in the first category spoke of their resentment about being forced to choose between research and teaching. They saw teaching and the public communication of history as an important part of its disciplinary form. In this context it is interesting that the small number of those we interviewed who were employed in casual teaching-only roles were the most hesitant to identify as historians. These interviewees had been trained as historians and usually had completed a PhD. But they talked of not being part of department meetings even though they did the bulk of the teaching, and not receiving recognition by their full-time colleagues as part of the disciplinary community.

'In the time since you began studying, do you think the discipline itself has changed much?'

In their responses to this question, historians and physicists both touched on some changing elements within their field and some changing contextual impact of university policy and governance practices on their field, but the relative emphasis

to endogenous as compared with exogenous change given by the two groups was strikingly different. (Interestingly, with the exception of some references by physicists to the speed of advances in research in recent times, none of our interviewees chose to speak at any length or detail about the impacts of changed technology, though these have been significant in both fields as well as in teaching and learning more generally. This possibly reflects their interpretation of the focus of our questions, and the fact that we did not ask specifically about technology.)

Physicists reflected at length on the changing scope of their field, the endogenous developments. A number commented on the speeding up of discovery as a result of computing power and the kind of work enabled by new technology and in the kinds of global collaboration evident at CERN and in the Square Kilometre Array (SKA) project; the new collaborations with engineering and biomedical research; research at the nano level that was beginning to blur some of the boundaries between physicists and chemists working in that area; even the potential emergence of some of this work into recognition as a new discipline.

> I guess the other aspect of it is complexity, too. A lot of the easy problems are gone now and a lot of the problems that remain are hard ones you can't tackle on your own. You either have to tackle them with people in other specialisations in physics or other specialisations in other fields as well.
>
> (Academic 23: physics, non Go8)

> There is, I guess, much more interdisciplinary work now than I was aware of in my younger years. And certainly we get told that the interdisciplinary nature of research is increasing so I believe that's probably not just my perception, it's actually changed. […] Biophysics didn't really exist when I was in high school as a field, and there's various other things where you're interacting with chemists and doing chemical modelling and things like that that just wouldn't have happened. I guess we didn't have the resources to do some of those things.
>
> (Academic 36: physics, non Go8)

> If you trace back to say the mid sixties, when the first laser was first operated, at first the laser was an invention without a use, now it's everywhere. Similarly in that time, the transistor semiconductors were invented and now they're everywhere and the ability to be able to study what goes on with those guys and to develop better versions of it. There's been an enormous investment in the study of that sort of stuff.
>
> (Academic 46: physics, non Go8)

As we will note later, physicists also had things to say about exogenous changes to the environment in which they worked—current forms of performance management, research assessment, regulation of doctoral studies, mandated interdisciplinarity for some funding purposes and the like—but these came across as irritants to be managed and combated, not as factors that were fundamentally changing the field itself.

For historians in Australia, the exogenous changes were at the centre of their concerns. When we asked how they saw their field changing since the time they began studying it, most of the discussion focused on management imperatives and the impact of the changed university environment for their work. The financial

pressure on the humanities that had led to fewer historians and collapsed departments, the pressure to produce articles rather than work on longer term and larger projects, pressures either to publish in a narrower range of journals for research assessment purposes, or conversely to move towards more useful collaborative projects, difficulties of funding and much heavier teaching loads, the requirement to do more teaching not connected with their specialist interests, being forced to choose between being a researcher or a teacher, were some of the things mentioned here.

That these changes are not simply contingent issues about working conditions but confront some characteristics of the discipline itself might be predicted from some of the earlier sociological work on the disciplines (discussed in Chap. 3). Here, for example, Muller (2009, 211), drawing on Biglan (1973a, b), Becher (1989) and others, noted some contrasts in how physicists (as 'hards') experience workload and priorities compared with historians (as 'softs'):

> The 'hards' are higher in social connectedness [i.e. in their research activities], so they collaborate more in teaching, especially at the lower levels where less is contentious. Consequently, they spend far less time than the 'softs' in lesson preparation. Since their teaching, research and supervision is better integrated, and since they spend less time on supervision – less than a quarter of the time spent by 'softs' […] – they have far more time for research, which they see as their fundamental mission as academics. The 'softs' by contrast spend far more time both on lesson preparation and on actual teaching; they spend far more time on undergraduate teaching than on supervising postgraduates, unlike the 'hards'; and supervision is a far greater chore for the 'softs' than it is for the 'hards', because they all too often supervise outside their own specific research focus area […] Invariably then, they end up researching and publishing less.

In terms of changes internal to the field of history itself—its focus or methodology and the like, no uniform view was put forward, and historians in any case see such changes as normal and inherent within the discipline. Some historians talked about new foci (e.g. environmental history) or the big range of different kinds of historical work that now take place, and a number of them referred to generational differences, and suggest the current era is a more empirical and a less ideologically driven period than the 1970s and 1980s. A number too mentioned the influence of social theory, particularly post-modernism, and history's survival of attacks related to that. Some thought there had been some move to history from above (from a government or global perspective)—or to the kind of work that suits big themes, such as 'democracy'. For example, one younger academic suggested that history has moved away from being a more feminised 'grass-roots' subject to one more concerned with governmental issues (Academic 5: history, Go8), while another (Academic 21: history, Go8) suggested the subject has moved from seeking history from below to more complex and international perspectives. Another (Academic 24: history, non Go8) argued that a more conservative approach to history is being ushered in as older academics retire. Another (Academic 9: history, Go8) suggested there has been a strong move to cultural rather than social history in Australia because it is cheaper. But these came across as scattered individual

observations rather than widely shared perspectives on how the field had changed or was changing.

Why does your discipline matter?

Unlike with the previous questions, we did not ask this as a single specific question (though we did ask 'what do you hope your students will take away from your own subjects?'), and we draw here on comments offered throughout an interview as each academic described why they were drawn to that discipline, what they see as distinctive about it, what they indicate as their concerns about changes or conditions. The lack of a direct question in our schedule about why the disciplines matters (see the Appendix for further details) may explain why historians talked much more about what they hope their students get from doing history (in learning to work with evidence, and to produce integrative forms of writing and arguments) than about the value of historical work culturally and socially.

There were many comments from both physicists and historians in line with the arguments of Young (2008) and others discussed earlier (in Chap. 2) concerning the significance and depth of disciplinary knowledge for students' cognitive development. Those we interviewed did see the training and knowledge gained by systematic study in their field as vocationally useful beyond those who went on to work specifically in that specialist area, and indeed saw it as a deeper or more powerful form of education than the kinds of vocational skills courses that have become popular. One history academic for example commented:

> One of the things that annoys me a lot at the moment is the universities' lack of appreciation of the humanities in that I think the generic skills that I was talking about before, about the learning to research, learning to think critically and learning to write, are the kinds of skills that will get you a job, they're really great things to learn. Learning to think broadly, [to] get exposed to lots of different ideas and [to] learn to think about critical, surprising, odd things in the world around you. I think that prepares you for the kinds of jobs that are around and you know gives you a level of critical thinking and flexibility and powers of argument and expression, that are really valuable […] Whereas I think doing journalism [will not.] It will take you five minutes to learn how to write a website or learn a particular media ethics code of journalism or whatever, but if you're doing a university degree learning profession-specific skills, I think that's a waste of time. You can learn them when you get there and when you start your job, whereas spending more time learning generic skills that a classic humanities degree gives you, I think is much more valuable. So I think there's a negative trend away from generic skills into specific professional skills because it's seen as more employable.
>
> (Academic 47: history, non Go8)

When discussing the value of a physics degree, academics largely felt that physics content came first and that out of an understanding of this content a number of very useful more generic skills were developed in students. The physicists mentioned a number of different fields and professions that graduates had gone into: economics, consulting firms, government, mathematical modeling of various scientific and social phenomenon. They talked about wanting better marketing of their subject and the value of training in it for a range of vocational careers. Many

felt that a physics degree has always developed a particular type of thinker and that in recent years there had been a push to make this more explicit but in a way that is not necessarily aligned with their desire to see a degree in physics valued for what it is:

> I don't think I ever heard of an attribute when I was an undergraduate.
>
> (Academic 1: physics, Go8)

The focus on generic skills and graduate attributes was largely perceived to be a top-down strategy within universities but few physics academics believed that this push inherently changes what is taught within physics, as they see these types of skills as already inherent within the discipline.

The historians we interviewed similarly believed that their subject offered broad social usefulness. A number of them spoke about the vocational relevance of historical skills—in learning to investigate and question, analyse and synthesise materials and develop a clear argument. They saw history as relevant to high-powered careers (law and medicine for example).

> At third year, they should be writing, you know, sustained bits of research and analysis, I think, so that they come out – I know they're not going to be historians. So they come out like one of my PhD students [who] went off to be in the Human Rights Commission and he writes reports […] Great reports, because he does—he's good at that whole topic sentence argument [structuring of writing] and that's his thing. If they can come out being sophisticated thinkers so use evidence responsibly, then that would be great. And, write well. It's key.
>
> (Academic 21: history, Go8)

Somewhat parallel to the physicists, their concern was that the more explicit emphasis on vocational utility and graduate skills in recent times was creating an orientation that worked against a more traditional understanding of the way in which humanities study was expected to underpin work capability. They saw the emphasis on vocational utility today as encouraging students to look for subjects that appeared to be vocationally labelled. One historian commented:

> The problem I think with the context now is that from government policy, in terms of their relative rating of history, we get paid nothing for our students anymore, and [secondly] this sort of notion that everybody needs to be articulating directly into a job from their first year at university. […] Unless you can convince them it's going to get them a job, it looks problematic. Mind you, I don't see what they're all thinking media is going to do for them […] We get fewer Arts/Law students than we used to, and that's one of the great drains for humanities generally, because they are all off doing common law or business law.
>
> (Academic 21: history, non Go8)

Here history potentially suffers by its horizontal form. Without a compelling vertical claim which would see historical knowledge as a foundation of knowledge and capabilities more broadly, the subject is at the mercy of student choice, or of the personal preferences of those in power. In the period in which C. P. Snow was writing in the 1950s (e.g. Snow 1959), and to some extent in Australia through the

mid to late 20th century, many people aiming at political or public service careers were history graduates and valued that preparation. This continues to some extent, but has been diminishing. Now economics and management are favoured studies, or languages are favoured studies for those seeking careers in politics and public service.

So academics in both disciplines make convincing cases for why their disciplines matter in terms of the development of vocational skills and capabilities, but because of the vertical structure and claims to be foundational of their field, physicists are able to present a more convincing case about the importance of physics within a broader curriculum structure, while history is at risk of some undermining in relation to that.

The Disciplines and the University Curriculum

'What kind of guidelines/agendas/aspirations are part of developing subjects in this field, and how are they taught and assessed?'

'Thinking about the courses that are taught in your department, how much, in your view, are they directed toward building knowledge in your discipline, and how much toward more generic agendas?'

'Thinking about knowledge-building in [your discipline], what kind of things should be done at the school, the undergraduate and the postgraduate research level?'

Physics

As we noted earlier, at the undergraduate level, physics continues to be viewed by physicists as a vertical discipline, with some clearly established core elements, and with an increasingly sophisticated level of mathematics required. While undergraduate degrees in physics do not face the same level of scrutiny placed on some professional disciplines for accreditation, the Australian Institute of Physics (AIP) does audit physics degrees. Similar to the school level, it was discussed in interviews that the AIP takes issue with degrees that have removed part of the laboratory work required to obtain a physics major. At the undergraduate level this practical understanding of experimental work was seen to be core to a physics degree and is something that universities have had to adjust over the years in response to tightening budgets.

To be able to be a researcher in physics does require a lot of specialist knowledge as a foundation, especially in the levels of mathematics required. No one interviewed, even those who had been recruited to set up such courses, thought that a course structured in terms of a new form of interdisciplinarity or contemporary

problem-focused such as nanotechnology was a satisfactory replacement. (This is discussed further in Chap. 10 in relation to interdisciplinarity.)

> So a lot of these nanotechnology courses started probably as an undergraduate course. We had one here. The students come in. They do a little bit of physics, a little bit of chemistry, a little bit of biology, a little bit of material science. And what ultimately happens is at the end they come out and they are jack-of-all-trades and masters of none.
>
> (Academic 23: physics, Go8)

This does not mean that the physicists we interviewed were all against subjects such as environmental studies at the undergraduate level. They saw a need for students to get some exposure to the bigger field and types of questions of current day science before specialising, and would also value humanities students having some exposure to this. But they do not want this to be at the expense of the specialist major to underpin research degrees.

The perspective of physicists that physics is a 'fundamental' field has ramifications for the undergraduate curriculum. On the one hand, 'fundamental' can be interpreted as 'most important'—and interviewees reflected a perspective that physics is a difficult field, specialised, hierarchical, able to be pursued only by a relative few and as such a field that is elite, a sign of quality. This in turn underpins their thinking about what needs to be retained in a vertical curriculum structure. At least in research-intensive universities, it also feeds a case for keeping physics strong as a sign of the university's competitive research quality.

At the same time, for physicists, 'fundamental' also means 'underlying everything', 'pervasively important'. The role of physics in underpinning advance and many aspects of technological innovation we use every day, means that physicists often favour ways to give non-physics students some small foundation, insight, respect (and awe) about this field. This was not universal and some physicists we spoke to resented having to spend time teaching non-physicists, but a large number spoke enthusiastically about such subjects and emphasised the importance of having physics components of other subjects taught by actual physicists who can properly convey what is important about the field and why it matters.

In their perspectives on school curriculum and physics, the university physicists we interviewed were concerned that it be constructed in a way that would attract enough (good) students to physics. Alongside this, they had some concern with establishing foundations, given the hierarchical nature of physics and the role of mathematical expertise in it. There is no easy answer here. In one state in particular physicists were critical of moves that they considered had tipped the curriculum too much towards a sociological perspective on physics rather than demanding a sufficient quantity of mathematics or experimentation. Yet the social perspective on physics and what it can contribute is one of the strategies that has been used to attract more interest in physics, an agenda that many other physicists interviewed argued for. And some attention to the social value is one of the dimensions believed to ameliorate gendered patterns of entry to this discipline, another concern of this field (this issue is further discussed in Chaps. 7 and 8).

A similar point raised a number of times was the detrimental effect on physics undergraduate student numbers where some states had removed mandatory pre-requisite subjects at the school level (for example, not mandating year 12 physics as a pre-requisite for those wanting to study engineering). Yet that move had been initiated precisely because universities and/or particular programs were concerned about excluding potentially good students by such mandating. There was an awareness too that the current culture of higher school certificates was leading students capable of doing physics and high-level mathematics to either not choose those subjects but find easier ways to achieve a high ATAR score, or to take the subjects but then proceed to the university subjects with the highest cut-off entrance scores—medicine and law—in part because the highest cut-off scores were equated with highest prestige. As we noted earlier when discussing issues impacting on school curriculum, there is a peculiar Australian discourse among parents and students about 'wasting your marks' if you choose to take a course that requires a much lower entry score than the student in fact achieved in their final high school year.

In relation to students who do take on physics degrees, a lot of attention is given in the first undergraduate year to establishing and assessing the necessary foundations in mathematics. There is an expectation too that the shape of numbers of those doing physics degrees will be pyramidal, as less able students are weeded out.

The move to knowledge creation tends to come at the honours or masters level for physics, depending on the degree structure of the university. Possibly as a result of the knowledge explosion in physics and the inability to fit enough well established physics in at the undergraduate level, physics departments are pursuing coursework as a major component of the honours year and masters and PhD degrees. Following this it is then possible to pursue 'meaningful research'. This involves both greater specialization and narrowness of focus and also a breadth of understanding of where your work fits in.

> I can't even really start to talk to my masters students about what their project is until they've done about a year's coursework, at master's level. Because they don't even have the language to understand how to attack the problems. You can talk in just general terms at the level of popular science even, but not at a technical level, so it's something that the people in other disciplines I think, find hard to understand and strange.
>
> (Academic 13: physics, Go8)

At the research level many discussed the creative side to pursuing new knowledge in physics.

> You are pushing new ground and you are being in a very important way more creative. So one thing that non-scientists frequently fail to understand is that science is a creative activity, that the usual caricature of a scientist in Hollywood movies is of someone who is intensely logical and somehow takes data and this inevitably leads that person to some grand theory through some very very logical process; and it's often not like that because you have to take imaginative leaps, all the time.
>
> (Academic 13: physics, Go8)

This combination of high level specialist knowledge and creativity in taking it forward was commented on by a very successful research physicist, talking about why he prefers to use oral rather than written examinations at the third year level:

> I guess there are two aspects to doing a physics course. There is the intuitive understanding of what is happening, which is the physics and then there is the language in which that is cast, which is mathematical. And so what you often find is—and as you progress to higher and higher levels of physics– the maths becomes more complicated. And I just felt that you find if you try and set a written exam, you find yourself examining mathematical ability more than you do the [conceptual]—[you cannot test] whether or not they understand the physics of what is going on, unless you examine with an essay. And if you're going to examine it in an essay you might as well talk to the person.
>
> (Academic 21: physics, Go8)

The need to be creative and the time required to successfully complete a meaningful physics PhD was also brought up as being a problem with the current system that is pursuing a punctually completed three year PhD.

> Well, when you are doing research it might take you nine months to do a calculation and it could take 200 pages and several computer programs and mathematical notebooks, and so on. Yeah, so it is just, it is a complex activity and requires a lot of time and effort to eventually shape semi-chaotic thoughts into a coherent analysis. […] So sometimes the time limit is a nuisance. For most people it isn't, but it can be, depending on the individual, and depending on the difficulty of the problem that they are trying to address. Because again, you are doing research so you do not know how difficult a problem is going to be.
>
> (Academic 13: physics, Go8)

In physics, as in many of the other science disciplines, PhD students are often given a pre-determined topic for research by their supervisor, but the supervisors explain here that this does not itself determine when and how breakthroughs occur. Nevertheless the monitoring of time limits on doctoral study, they suggest, may lead to more conservative kinds of topics and approaches to discovery than may otherwise be the case.

> You end up trying to not offer students challenging projects anymore, because you know that there is a risk that the university will try to throw them out before they manage to finish them […] So, if you want to go after the hard things in your research, it becomes harder to do. You cannot offer students what can be possibly slightly riskier but slightly higher return projects if they come off. So you do not want to throw them something challenging anymore.
>
> (Academic 23: physics, Go8)

The more limited amount of time students now have to spend on a PhD is seen as a possible issue as students may not have the time to be creative in their thinking and the leads that they follow and this limits their development as research physicists.

History

> It always really frustrated me when I was a tutor at [a Go8 university] and doing a PhD on curricular history teaching that there wasn't enough curriculum coordination in the

> department […] And the teachers didn't take teaching as seriously at that, I don't know if meta-level is the right word, but at that organisational level.
>
> (Academic 41: history, non Go8)

> We sometimes do have really productive programmatic discussions about how we would want the curriculum [to be] and therefore the people that we would want [to teach in it] but it never turns out at the higher level to translate to the actual people that we get […] So it's a bit frustrating in that way, that we do have curriculum discussions at a theoretical level but in the practice it doesn't often turn out that way.
>
> (Academic 44: history, non Go8)

As with school history (see Chaps. 5 and 6), the issue of what should be covered in history is a difficult question and there is little agreement about what an undergraduate major in history should look like in terms of the content covered. It has been common for history programs in Australia to begin with some large first year subjects and then offer a wide array of later year subjects, frequently driven by the specialty research areas of the academics employed in those departments. In their 2004 review, Millar and Peel found teaching programs tended to be driven by the changing expertise and capacity of staff, resulting in what they saw as a 'smorgasboard' approach rather than 'the deliberate creation of a coherent curriculum' (2004, 15–10). However this assumes that coherence lies in content covered rather than in building combinations of specialized study. In contrast to physics and its ready naming of stable core subject content units, history programs had readily changed as new areas—gender or race or environment or Asian studies—become topics of general cultural or intellectual interest, sometimes in new cross-disciplinary collaborations, sometimes as a within-discipline initiative. In all this the forms of the disciplinary knowledge-building demonstrated characteristics of the 'horizontal' and humanities forms identified in previous literature.

For history, and unlike scientific disciplines, it was clear from the interviews that there is no single rationale inherent in the discipline itself that can define curriculum content or topic selection and structure. One of the interviewees commented that history departments are generally incapable of having a curriculum discussion—for example about the form of the capstone subject:

> The capstone, I guess it is meant to be a kind of rounding out of a cohort experience and really passing on key ideas about knowledge and approaches and methodologies that we think you having done it, a BA [Bachelor of Arts] in History should leave with. But when this was being discussed, I thought that is something that everyone has a stake in. Like everyone in our school should have something to say and we should be able to discuss this to work out exactly what we think and what we disagree with and all that sort of stuff […] but people just sort of—someone said, "Oh, but we're not going to agree on this," so it kind of wasn't discussed. It wasn't really—you know, it was put off to the people who were organising it and they went and did it.
>
> (Academic 9: history, Go8)

Another commented that 'even the most successful history programs you write down the topics they teach as a list and it's very hard to see what the coherence is' (Academic 8: history, Go8). Another younger interviewee (Academic 9: history,

Go8) said the value of being pushed to interdisciplinary teaching is that they are forced to have an intellectual pedagogical discussion rather than just going on teaching what they did. Many of the interviewees wanted a breadth of subjects to be offered in the undergraduate program, but this tended to be more about providing options for students than setting out a program of study.

In terms of knowledge-building over the undergraduate and research phases, historians spoke of an increasing sophistication of investigation and writing expected at each stage, but not in the form where certain content must be learned as foundation for other content as it is in physics (though subjects about a certain period or national setting may choose to require another subject as a contextual substantive pre-requisite for that study):

> [Later years are] not so much different as in much, much more depth and expecting much much more analysis than I would expect at undergraduate level. And undergraduate level to some extent knowing what happened and knowing that one needs to know why [is important]. That things did not just happen one after another in a pre-determined order …that there was no other way of that happening. Whereas at postgraduate level I would expect that to be a given, and that there would be far more going into trying to work out differences and engage with different theoretical [...] perspectives on a given problem.
>
> (Academic 11: history, non Go8)

> I mean in an ideal world, similar things should be done at every level just with increasing complexity and increasing sophistication and increasingly driven by the student rather than by the teacher—so by the time you get to postgraduate level, it's being driven by the student.
>
> (Academic 45: history, non Go8)

While some historians saw the university curriculum reforms that forced them to move away from offering a broad array of subjects that could be taken by students at either a second or third year level as a regrettable narrowing of the curriculum, others were happy to accept current moves by university teaching policies to require departments to define more clearly what is expected at each level:

> I am happy to say as of last year we finally moved across to single code units for that progression of first, second and third year. And we are still only in the process of changing but we have finally come around as a group to saying, look, we need to work out across the board—obviously we have a lot of elective students that come and go, that is fine, you cannot cater for everyone [...] but for our major students, those doing a history major, we need to be able to teach them at first year level what it is to be a historian and what sort of skills they need at the basic level, but then we need to make sure that second level we start to up the ante a little bit as far as the expectations on these students, but also the knowledge and the expertise and the skills that we can provide for them. And then that natural progression of course takes you through to the third year as well so that we can be confident that by the time they get to the end of it, they've built that up.
>
> (Academic 26: history, non Go8)

In terms of how university historians saw school history compared with undergraduate history, three kinds of issues came up in our interviews. One is that there has been something of a circular and reciprocal relationship between senior school curriculum and what kinds of history students are interested in at university, and

this becomes apparent in differences between what is popular in different states—Ancient History in NSW, 'Revolutions' in Victoria, and the like. So a new mandated national school curriculum that changes those offerings and the curriculum scope or focus is likely to produce some consequences and different patterns of choice at the tertiary level.

A second issue relates to what broad general knowledge of history should be expected of those studying history. Both academics and history teachers in schools were uneasy about setting up a central received narrative, or over-emphasising history as facts and dates—but at the same time a number of academics expressed concerns about students who lacked some basic orienting sense of history, and who lacked some broad and broadly accurate sense of the history of the world.

> At the school level, I think students should be familiarised with every important period in history, preferably of course, without the old-school Eurocentric approach. So they should have an understanding of the basic features of the leading civilisations in human history. At the undergraduate level, that generalist knowledge in a certain discipline should be expanded. So more depth should be given to them, as broad understanding. And at the MA [Master of Arts] level, the postgraduate level, students should be allowed to specialise in a specific period, and then carry on with the PhD.
>
> (Academic 34: history, Go8)

> I'm not sure that an undergraduate, a student who finishes their honours degree and is about to start a PhD, whether they need to know the 400 central facts about Australia to then become a good Australian historian. I feel that is more important in schools because by the time you get to university, just to have the skeleton in your mind about what happens so that then you can go and start developing your skills that you have just started to learn at school such as research skills, argument, discussion, that's more of a step up perhaps. […] I think an honours thesis could be a chapter in a PhD and I think a good research essay at an undergraduate level could be like a mini chapter in an honours thesis.
>
> (Academic 41: history, non Go8)

A third issue is a particularly interesting one in relation to the discussion of vertical and horizontal subjects. The senior school history curriculum, though it varies by state, gave considerable attention to historiography (methodology). In one state, for example, students were expected to do an original investigation, and to not only produce a research report on that, but to produce an equally lengthy detailed account explaining and justifying their various searches, annotating their bibliography, etc. Teachers in this state were quite critical of university history, which they saw as not building on the level of knowledge and sophistication that these students had developed, but starting some steps back from that. And in general the teachers in that state lamented the lack of interaction between school and university historians. But in many universities, historiography has been traditionally taught at the third year or fourth year honours level—that is as a reflection on the field and its debates rather than as a 'how to do it' orienting mechanism. That is, there are questions about whether this form of methodological knowledge is part of the foundations, and able to be built by structured technical guides or whether that assumption shows a misunderstanding of how knowledge in this field is developed.

The contrary perspective to the one voiced by the teachers in the case above was voiced by a number of university historians, who contrasted what they saw as a very regimented approach to school history (backward mapped from the assessment criteria and potentially formulaic) to the one they were striving for at university level, where the evidence that might be taken into account is potentially unlimited, and where making judgments about what is relevant is part of the challenge.

> So it was about trying to use their intellect and trying to get them to express themselves rather than just get a good mark, which is sort of what I think a lot of them had been trained in that VCE [Victorian Certificate of Education] funnel to do. They had come out of an environment where if you do not need to know it for the exam it can be pushed aside and at university it is kind of the opposite […] So some of the students, they were so opinionated in tutes, and just fantastic to be around and have around. But then when it came to their essays, they were kind of trying to do the formula and it wasn't quite working. So I found that fascinating and during the course of taking that course I worked really hard to try and turn some of those attitudes to history around a little bit.
>
> (Academic 41: history, non Go8)

> I do feel in first year you often have to seem to correct or change student's perception of what history is at school. I feel like there is a highly structured school curriculum which affects the way that they think about knowledge, the way they think about facts and objectivity and writing in very structured ways, if they can write at all. And so in teaching here and in the UK, I did feel like I was undoing lots of what they had been taught in school in first year.
>
> (Academic 47: history, non Go8)

This does not mean that university-based historians were dismissive of the need to learn some basics, particularly about sources and evidence:

> I have not taught at secondary school level but I would hope that students are introduced to primary sources there. Taught to ask questions about what is this, where does it come from, what can we know about it, what can't we know about it, what can it tell us, what can't it tell us and what does that mean?
>
> (Academic 9: history, Go8)

> High school students need to learn how to write topic sentences, right? And what follows in a topic sentence in a history essay. If they come out understanding evidence and knowing that they have to cite their sources just even generically, even if it is just a rubbish textbook, that would be great.
>
> (Academic 21 history, Go8)

However the historians imply a gap exists between learning these tools and achieving a good historical account. They see one difference between history at the university level rather than at the school level as its open-endedness, and the issues of judgement that have to be made by both student and assessor in judging what is to be explored and included in their narrative.

Although much of this seems to reinforce the contrast between physics and history, in terms of moving from undergraduate to the research level, there is actually some parallel in how physicists and historians describe their concerns about current times. In particular, one of the concerns of historians is that as history departments have been reduced in numbers, and forced to teach a smaller number of

more general subjects, that the specialist knowledge of particulars that is part of studying a particular period is being diminished:

> The difficulty I think that we have at the moment with the […] history part one, two, three, four […] is that students who want to then undertake a doctoral study of a particular topic, really have not read themselves into the history of that topic […]. There's someone who is doing a study of the Paris commune, they really need to have understood both French history from the revolution through to the first world war and a broader European history, in order to make much sense of that topic. And [because of reduced subject offerings] there's no longer an opportunity to do so, that is the problem.
>
> (Academic Professional Association 1: history, Go8)

> Increasingly we find that students do not have enough of the body of knowledge at the undergraduate level which you sort of take for granted should be there before they embark on a research project at the level of sophistication required in either an honours degree or postgraduate degree. And frequently for various reasons they do not have that basic body of knowledge and they therefore do not know what the historiographical debates are, they cannot place a particular historian. So they do not have the necessary overview.
>
> (Academic Professional Association 2: history, non Go8)

Conclusion

In this chapter we have focused on the ways historians and physicists talked about the form of knowledge that comprises their discipline, particularly in the context of their thinking about the university curriculum. The chapter has brought out some of the differences between history and physics as horizontal and vertical fields, but also some of the similarities in the challenges both fields are facing within the current university climate. Those we spoke to demonstrated a strong commitment to their discipline. Their identification as historians and physicists and their belief in the value of their field is very strong, and continues to be so in the face of a push for more directly taught vocational skills, or a more interdisciplinary form of organising the curriculum. There is potential self-interest in this, but it also indicates the strength of disciplinary fields in developing researcher identities and in developing particular ways of thinking that have broad value. The academics we spoke to felt strongly that the study of their discipline provided a stronger basis for the development of generic or vocational skills than skills-based subjects geared directly towards those agendas, and they generally also suggested that disciplinary study provided a stronger foundation for research than could be gained through beginning with interdisciplinary courses (discussed further in Chap. 10). Their concerns about building knowledge in their respective discipline touched on the problem of how to balance the introduction of fewer and more general subjects in recent undergraduate curriculum reforms with the building of specialist knowledge.

The current chapter also demonstrated some of the challenges faced by more horizontally structured fields in response to management shifts and expectations.

There has been considerable debate about the negative impact of changes to government funding of universities on the humanities. Here, we have shown how these concerns are evident in relation to curriculum development and the form historical knowledge takes. While vertical fields such as physics are able to present a stronger case for their continued necessity (as 'fundamental') and their foundational role in vertically structured knowledge within the undergraduate curriculum, the specialist empirical knowledge or expert needs of history (in terms of prolonged, specialised study within a particular period or national setting for example) are less easily demonstrable to management and are vulnerable to cuts.

References

Becher, T. (1989). *Academic tribes and territories: intellectual enquiry and the cultures of disciplines.* Milton Keynes, UK; Bristol, USA: Society for Research into Higher Education; Open University Press.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor and Francis.

Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3), 195–203.

Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 53*(3), 204–213.

Maton, K. (2009). Cumulative and segmented learning: exploring the role of curriculum structures in knowledge-building. *British Journal of Sociology of Education, 30*(1), 43–57.

Millar, C., & Peel, M. (2004). Canons old and new? The undergraduate history curriculum in 2004. *History Australia, 2*(1), 14.11–14.13.

Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.

Snow, C. P. (1959). *The two cultures and the scientific revolution (the Sir Robert Rede Lecture)*. Cambridge: Cambridge University Press.

Young, M. (2008). *Bringing knowledge back in: from social constructivism to social realism in the sociology of education.* London: Collier MacMillan.

Chapter 10
Disciplines and Interdisciplinarity

In recent years there has been increasing interest in interdisciplinarity and pressure to pursue interdisciplinarity at the university level. In Australia, this is directly reflected in government policy documents (Woelert and Millar 2013) as well as in a range of university-led initiatives purportedly aiming to foster interdisciplinary knowledge activities. This increase in interest has its grounds in a range of expectations that are associated with interdisciplinary knowledge activities. These include expectations that such activities facilitate better integration of university-based research into the wider 'knowledge economy' and expectations that interdisciplinary research is particularly well suited to address the world's 'wicked problems'. In relation to undergraduate teaching interdisciplinary curricula are seen to develop capabilities that are important for students' participation in the current and future workforce and to expose them to some of the more complex issues facing society today.

As we noted in Chap. 2, epistemological justifications for interdisciplinarity tend to be concerned with limitations of disciplinary knowledge boundaries and communities. However, others see interdisciplinarity and disciplinarity as intrinsically bound together (e.g. Klein 1996; Jacobs and Frickel 2009; van Leeuwen and Tijssen 2000). It is often acknowledged in these accounts that the search outside disciplinary boundaries for ways of advancing knowledge may originate both from within disciplinary contexts as well as from interdisciplinary ones, leading sometimes to the formation of new disciplines such as biochemistry (Klein 1996). In this respect, at different times an area of knowledge may have properties that could be considered either disciplinary, interdisciplinary or both. Other arguments for interdisciplinarity have been concerned with the perceived rigidity of disciplinary boundaries and concern that some disciplines actively retain these boundaries in order to maintain reputation and hierarchy.

In policy and in public discourse, justifications for interdisciplinarity are primarily instrumental and relate to its ability to address real-world or 'big' problems

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(discussed earlier in Chaps. 2 and 4 of this book). Although these latter initiatives are often couched as concerns about developing 'interdisciplinarity', in their assumptions and purposes they are often more aligned with the body of work described as the 'new production of knowledge' (or 'mode 2 knowledge') discussed earlier in Chap. 2, which has a different set of assumptions about knowledge and innovation and how this is built. In those arguments the interest is in the kinds of collaboration that are needed and the social and applied purposes that need to be built into knowledge creation, with relatively little attention to the role that disciplinary knowledge or contributions can or should play in this.

This chapter will explore how the historians and physicists we interviewed position themselves and their knowledge work in relation to the various policy drivers and discourses concerned with interdisciplinarity. One focus here is on how these academics frame the epistemic relation between their own disciplinary knowledge work and interdisciplinary forms of enquiry and education. Another is on the academics' perceptions of how current policies and institutional settings impact on the interplay between disciplinary and interdisciplinary knowledge in their work.

Interdisciplinarity and its Relation to Disciplinarity

Disciplinary Identity

Our interviewees were selected because of their disciplinary association with history or physics, and whether or not they were now working in a bounded disciplinary setting they had generally themselves been trained in such a setting. However few of the physicists and historians we interviewed had worked only in narrow disciplinary contexts—most had had some experience of either interdisciplinary teaching or of being involved in interdisciplinary research projects. The interviews indicated that many historians and physicists actively borrow from and conduct research within other disciplinary contexts, and a number are situated within interdisciplinary schools. Even those who did not undertake any interdisciplinary work acknowledge that there is a place and need for interdisciplinary work. At the same time the interviewees usually continued to identify quite strongly as physicists or historians.

Almost without exception, when we asked if they saw themselves as physicists and historians our interviewees responded with a definite 'yes'. Across both early career academics and senior professors, and including those now working in interdisciplinary areas, the discipline came across in the interviews as a strong part of their identity:

> I would have called myself a historian even though I was in work in a range of different contexts […] That was my training, that is my passion.
>
> (Academic 35: history, Go8)

> I normally say Professor of [names the substantive applied focus of his role] and that lets people know who the hell we are and what I am doing. But late at night, three in the morning when I am watching some bad television, I am just a historian.
>
> (Academic 24: history, non Go8)

> For me, absolutely, I consider myself a historian. Very, very strongly.
>
> (Academic 41: history, non Go8)

> We like to decompose things into the component parts. In that context I probably am very much a physicist at heart.
>
> (Academic 4: physics, Go8)

> I feel that the blood of Galileo runs in my veins in some ways as the first physicist. And indeed, I had the pleasure of going to Florence last year where I got two hours with Galileo's actual astronomical notebooks from 1609, one of the greatest artefacts of western civilisation […] Yes, I certainly feel as though I am a physicist.
>
> (Academic 3: physics, Go8)

> Yes, I am a physicist in the terms of my discipline. I am a physicist in terms of the way that I will look at a problem.
>
> (Academic 4: physics, Go8)

> I would describe myself as a physicist. [laughs] When I fill in departure cards [laughs].
>
> (Academic 6: physics, Go8)

> I suppose I am part of that generation that received a training in the discipline, however defined. And I guess I have an investment in that identity.
>
> (Academic 2: history, Go8)

For many of the academics, working in interdisciplinary contexts was more likely to reinforce their disciplinary sense of self than lead them away from their core disciplinary identity. In an email exchange that occurred after we provided copies of the interview transcript, one historian commented:

> My added observation is that, at home in a history program, I feel unconstrained by the discipline, that the boundaries are porous, the discipline relatively catholic, and that I can do whatever kind of work I want. It is on the other hand in interdisciplinary contexts (classrooms, conferences etc.) that I often start to feel like a historian, conscious that I would not approach a topic in the way that people from other disciplines have.
>
> (Academic 8: history, Go8)

A physicist commented similarly, that opportunities to work with colleagues from other disciplines and to draw comparisons has the effect of making one's disciplinary identity more explicit:

> I actually think every field is distinct, and I think when we realise the distinctiveness and the similarities that we really appreciate what it means to be within a discipline. Because if we push within the discipline, when we do not compare with the others, we do not really get that feel. I think that is something that needs to be discussed and made more apparent; it is not out there in the same way as it should be. We talk about multidisciplinarity but we do not actually talk about why in terms of education, and our identities, it is very important.
>
> (Academic 17: physics, Go8)

Interdisciplinarity and Disciplinary Difference

In Chaps. 3 and 9 we discussed differences as well as similarities between history and physics. In relation to interdisciplinarity, both sets of interviewees were comfortable talking about disciplinary compared with interdisciplinary work, and identifying how their discipline approaches topics differently from other disciplines working on the same topic. Both groups also noted that at the borders the disciplinary boundaries are not always clear-cut. But the different forms of the two disciplines also bears on the ways our interviewees experience and respond to the interdisciplinary agenda.

As we showed in Chap. 9, physicists have a strong, shared and explicit understanding of a core agenda and fundamental ways of approaching problems that they see as differentiating physics from other fields of science. Historians, although they have a strong sense of their discipline and disciplinary identity, see history as having 'very blurry borders' and as readily incorporating elements and theories from other disciplines. (However we also found that among historians there is a less unified view of the issues we discuss in this chapter than we heard from physicists). It is not surprising then that, the form in which current interdisciplinary agendas of universities and funding schemes impact on our two sets of interviewees is somewhat different.

Physicists were especially pre-occupied with the implications of changing research funding agendas, and the new preference being given to explicitly interdisciplinary forms. They draw a strong distinction between, on the one hand, the natural moves to collaboration and new disciplinary and interdisciplinary forms that emerge in the search for new knowledge and, on the other, the bureaucratic or top down setting up of a sharp distinction between disciplinary and interdisciplinary research. Nevertheless in both teaching and research, they see the kind of contribution physicists can make to interdisciplinary projects and subjects as being derived from a strong and secure disciplinary foundation.

Historians, who describe their field as in some respects having some inherent interdisciplinary qualities, were more conscious of the discipline itself being changed and possibly under-cut as a result of the new interdisciplinary agendas. In teaching, moves by universities to larger, more interdisciplinary and more generic subjects is widely seen by historians as a drive to save money. Historians find themselves in a renewed competition for students inside such subjects, and

with a smaller scope to offer the detailed history subjects on which degrees and majors were previously built. In the face of ERA (the national research assessment exercise) and of institutional priorities, they find themselves arbitrarily encouraged in some institutions to strengthen their disciplinary publication boundaries and in others to move in the direction of weakening such identification.

For physicists, interdisciplinarity, or at least collaboration with non-physicists, has expanded as part of the search for new knowledge.

> When I was studying in the 1980s there was less communication I think between the disciplines […] So no one ever talked about things like biophysics, or biophysics was very exotic. So […] we were never really taught about the bio links. Physics was very much, this is the physical world.
>
> (Academic 1: physics, Go8)

> You know there is some really interesting stuff going on at the interface between biology and physics and one reason is that physicists and biologists have a completely different approach to their sciences and they produce some interesting results when they get together. So you know there is interesting work going on.
>
> (Academic 42: physics, Go8)

While physicists were at ease discussing a range of active interdisciplinary research collaborations they are also very at home with being able to identify the differences between physics and engineering, and between physics and physical chemistry, even while they describe the boundaries of physics research as having become more blurred. They also mentioned a number of areas that had benefited from physics knowledge and discoveries. This included medical imaging, epidemiology and climate and economic modelling.

A number of areas of research were highlighted to demonstrate positive interdisciplinary collaboration. These included some of the bigger collaborations such as the Large Hadron Collider at CERN, where both theoretical and experimental physicists work closely with engineers, as well as smaller initiatives such as the use of lasers in the fine arts to date paintings. Biophysics was an area nominated by a number of physics academics as developing towards becoming a recognised new field—involving engineering as well as medicine and the biological sciences.

For historians, interdisciplinarity was seen differently to physics. As one historian explained, history can be seen as inherently interdisciplinary given the many different topics that are researched and in the borrowing of theories and methods from other disciplines:

> There's so many different ways of doing history. So it is a study of the past and it is intellectual understanding of the past, but we use many different tools to do that. And this is where the discussion about interdisciplinarity and history gets a little bit muddled, because in fact we use so many different analytical and explanatory devices and tools, and these come and go in fashion. They can be theory, they can be models, they can be economic phenomena, they can be statistical tools, they can be forms of political analysis, discourse analysis. So history has a huge [scope], it has more a sense of making sense of the past in a highly analytical way and trying to find core significance and outcome, so that [drawing in different theories and models] helps.
>
> (Academic 14:history, Go8)

Some of the historians also commented that change has occurred within their discipline and often in the direction of more interdisciplinary modes, although there was less consensus here than with the physicists. They felt that history has become more interdisciplinary in the way it borrows theories and methods from other disciplines, and this was often linked to feminism and the borrowing of theories from anthropology, sociology and philosophy.

> I think the major change is second wave feminism and just a whole host of different kinds of writing […] I could not do the kind of work I have done in the last 15 years without that. It just would have been not feasible. I would not know what questions to ask for a start. And I would not have been questioning the voices and documents and texts the way I can, and it is just those people that opened up the way.
>
> (Academic 28: history, non Go8)

> So I guess for me history is about incorporating numerous different theories and methods and tools. And it's about reflecting on—the point of history is to put things in their context […] to understand that things come out of a particular time and place.
>
> (Academic 5: history, Go8)

> So while I'm a historian I'm always looking and intrigued to see how other frameworks inform the past … the last book I wrote was actually on history of language.
>
> (Academic 2: history, Go8)

> I know it makes sense that people should have a sense of what is happening in literary theory. They should have a sense of what is happening in contemporary philosophy.
>
> (Academic 21: history, Go8)

The examples here refer not only to an understanding that changes in the world (such as the women's movement) make a difference to how history is done and the questions it asks, but that in this case the extent of the challenge to past ways of seeing led to an incorporation of different theories and complementary disciplinary perspectives as part of the study, one that has persisted.

Increasing Specialisation and the Knowledge Explosion

Both physicists and historians often spoke of the large body of knowledge that their discipline now encompasses. They noted a shift towards greater specialisation at the same time that different disciplines have become increasingly interconnected. The resulting breadth was seen to have benefits in opening up new questions but was also seen to limit the ability of academics within the discipline to fully understand all components of their own discipline.

> So research gradually gets more specialised, but at the same time it gets broader in a sense that the focus of an individual researcher tends to get very very specialised. If you look at 100 years ago, your physicists would know—it was possible to know pretty much the

> entire field in detail whereas now it is not any more. You cannot even know a sub-field in absolute detail. Whereas at the same time it has become much broader and the overlaps between fields have also become much more noticeable.
>
> (Academic 31: physics, Go8)

> [History is] much more interdisciplinary now and I think that identifies a good thing […] now there are multiple historical narratives, women's history, Indigenous history […] Some would say that is a bad thing because it fragments the discipline and then it means some parts do not talk to each other and so on. But it does mean that the specialisations that emerge really complicate the historical picture […] So there is the sort of theoretical diversity and then there is the empirical diversity […] I think that dynamic with other disciplines is really important, that inter-relationship between different branches of knowledge and how they impinge on history and how history impinges on them. I think that is much more open. It is much more porous as we say these days, yes.
>
> (Academic 2: history, Go8)

Physics was discussed both as reaching its limits in terms of 'we're starting to touch on the limits of where physics starts hitting against other subjects a little bit' (Academic 23: physics, non Go8) and in the 'complexity' of the problems that are now being researched, and that this requires collaboration with other specialisations within physics and other fields as well. So academics often saw a move towards more interdisciplinary research as being a consequence of the need to look outwards in order to pursue new knowledge, and in talking about this touched on issues of genericism and specialisation we return to in Chap. 13.

Interdisciplinarity as Learning from Other Disciplines

Academics from both history and physics spoke of the borrowing that occurred from other disciplines in positive terms—but did not see such borrowing and incorporation as undermining the discipline or need for disciplinarity:

> It reflects the willingness of many academics, I think, to look outside their own disciplines and try and learn as much as they can about other disciplines and make use of what the other disciplines have to teach and to broaden their own, or our own, skills and knowledge, so I think that is a good thing. But I do not think it—it does not have to result in a dilution of disciplines.
>
> (Academic 29: history, non Go8)

> Oh, I think it is definitely a positive thing because working with other people who have a different background from yours brings in just a whole range of new ideas, things that you have not thought about in the past, and you can sort of take those ideas and learn from those people and then use them along with your own knowledge to advance the area that you are working in.
>
> (Academic 32: physics, Go8)

While many acknowledged that addressing big challenges such as climate change may require interdisciplinary approaches, and while there was recognition that interdisciplinary collaborations can be fruitful and rewarding, the physicists and historians we spoke to were consistent in their belief that their primary contribution to interdisciplinarity lies, at least as a starting point, in their disciplinary expertise:

> I think it is very valuable for people to have one way of thinking that they are very used to and very comfortable with. And then to have the preparedness to go outside and learn other ways of thinking.
>
> (Academic 4: physics, Go8)

> It is very easy to say that the big problems are in climate change. Which is true, that is where they are, they are in climate change and they are in water, they are in renewable energies, and these are cross-disciplinary and that is true. And so it is very easy to say, "We are going to fund cross-disciplinary research", but none of those questions are going to be solved by people who do not have sound knowledge in the disciplines which underpin all of the complex aspects of those areas.
>
> (Academic 12: physics, Go8)

> I would not go on making a fuss about being interdisciplinary because you cannot be, as we know, until you have got a discipline or two under your belt.
>
> (Academic 14: history, Go8)

> You cannot have interdisciplinarity if you do not have disciplinarity in the first place. And sometimes I feel that it is a bit of a trendy buzzword, it sounds nice. It is [seen as] the right thing to do because it has this diversity and in a society that embraces diversity, which is of course something I would not contest but sometimes I think the term is used a little bit too easily. And lightly […] So I think that there is a certain risk with cross-disciplinary approaches if you end in a kind of scholarly no-man's land and produce, well, beautiful castles of hot air without any foundational research to back it up.
>
> (Academic 34: history, Go8)

The value of having a strong discipline based foundation prior to pursuing interdisciplinary work was a constant theme in the interviews.

Unlike the discourse seen in some literature and government papers that often positions disciplinarity as being separate or even opposed to interdisciplinarity (see Woelert and Millar 2013), the academics consistently presented a more entwined and complex view of how the two relate. This aligns more with some of the discussion in the literature that presents interdisciplinarity as coupled with disciplinarity (Abbott 2001; Klein 2000).

Academics also spoke of how they worked both in discipline based forms of research and in interdisciplinary research.

> So most people [who] really do good interdisciplinary research often do disciplinary research as well, which sustains them so they can then do this interdisciplinary stuff because the interdisciplinary stuff, in the end, it often comes and goes.
>
> (Academic 19: Pro Vice-Chancellor, Go8)

A number also described the need for interdisciplinarity to occur 'organically' and that it is something that occurs as part of the natural process of doing research.

> I think it is something that, it almost developed organically. It was a frustration that the people in biology and chemistry for instance were trying to get down to the molecular level and not really succeeding with some of their models. And the physicists were saying, well we know what happens with one atom [laughs] [and] you know what happens when you start with more complicated systems, so it was almost a natural progression.
>
> (Academic 36: physics, Go8)

Management practices that did not understand or allow for this organic process were therefore regarded as a source of tension.

The Management of Interdisciplinarity within Universities

As we discussed in Chap. 4, Australian government policy has taken up the idea of a 'knowledge economy' and repeatedly linked this to a call for more interdisciplinary and applied research activities, with some steering of research funding and funding programs to this end. A common view expressed in government reports and commissioned discussion papers has been that traditional, discipline-based knowledge is largely inward-looking and 'esoteric', and by its very nature unable to address the pressing problems and issues society is facing today (Woelert and Millar 2013).

In response to these changes in national policy rhethoric, the central executive of most Australian universities has created a substantial number of interdisciplinary research centres whose activities purportedly address 'grand challenges', or which are designed to facilitate practically-oriented research activities that involve close collaboration with industry of government bodies. Most universities have also introduced internal grant schemes and other incentives that encourage interdisciplinary collaboration both in research and teaching.

The historians and physicists we interviewed tended to perceive the key assumptions that underpin and serve to legitimise these directions as overly superficial and simplistic. Many also expressed concerns that current system-level and institutional arrangements in Australia remain inadequate to foster and sustain genuine interdisciplinary forms of enquiry.

It was common among both physicists and historians to see 'interdisciplinarity' as a 'buzzword' that tends to be mobilised in various contexts to brand and market one's research but which ultimately lacks substance and precision.

> So there's fashion in science and I think interdisciplinarity is a buzz word that you can pick up and run with and you can make it a kind of trend or a fashion in science and that did happen.
>
> (Academic 42: physics, Go8)

> Well, interdisciplinary stuff is a buzz word, it is trendy. It is what many people do, but in my opinion, only the very best can master the art of producing an interdisciplinary inquiry that is still fundamentally sound in every respect.
>
> (Academic 34: history, Go8)

> It has a bit of the flavour of something that is kind of modish, like transnational analysis. You know for a period of time if you did not put the word transnational in a grant application you were not going to get it and the use of interdisciplinarity in some contexts has a bit of that feel.
>
> (Academic 47: history, non Go8)

These sentiments were associated with a number of specific criticisms of policy and management assumptions and motivations about interdisciplinarity. Some of these criticisms related to epistemic concerns, others to political concerns.

First, as indicated earlier, the academics we spoke to frequently challenged the notion that interdisciplinarity was something that could exist separated from the epistemic foundation and orientation that is provided by the disciplines. There was a concern that one-sidedly incentivising interdisciplinarity in the contemporary university may have the effect of eroding the foundations of academic knowledge production more generally:

> I think it is a buzz word and I think it is not a craze, because I think it is here to stay. But I think it should not be pursued with—it should not be pursued if it means that we are going to lose disciplinarity. I think if we weaken off the disciplines as a consequence, it is not a positive thing.
>
> (Academic 19: Pro Vice-Chancellor, Go8)

Second, the common notion that interdisciplinary research was best suited to tackle complex issues and problems was regarded by some as being overly simplistic and not supported by actual evidence. Interestingly, particularly outspoken in this regard was a member of the senior executive of a research-intensive university—a scientist but not a physicist:

> I think it's interesting how these policies get formed and where the demonstration is […] We all say things, there are a lot of truisms out there you know "wicked problems are only resolved by interdisciplinarity". Well who says that? Where is the evidence for that? The wicked problems are unsolved but that is not to say they will be solved by an interdisciplinary approach.
>
> (Academic 19: Pro Vice Chancellor, Go8)

Third, there was a widespread resentment, particularly among the physicists we spoke to, that interdisciplinarity in Australian universities today, was by and large externally driven, and from the top-down.

> I think there has been a top down approach from the government through the ARC [Australian Research Council] and other funding bodies going back at least ten years now probably.
>
> (Academic 38: physics, Go8)

> I actually think it is coming from the top down, but I think it actually has not engaged the academics, from my experience, at the bottom level.
>
> (Academic 17: physics, Go8)

The physicists considered such top-down approaches to interdisciplinarity to be largely ineffective. A common theme was that these top-down steering approaches were unable to create conditions in which interdisciplinary collaboration emerges 'naturally' or 'organically' because the steering emphasis on short-term results undermines the scope for self-directed, curiosity-driven and more sustained forms of enquiry.

One physicist illustrated this point by giving an example of his own experience:

> So I have an experience of this myself, a few years ago. We applied to go to Heidelberg, to the European Molecular biology lab and they paid for us to go from here and the idea was that they were going to bring together a big bunch of fifteen physicists, fifteen computer scientists, fifteen biologists, fifteen mathematicians and fifteen chemists, put all these people in a big room and get them to talk to one another and somehow they would produce all this wonderful interdisciplinarity. It did not actually work very well. And I think that's what happened with all the thinking about interdisciplinarity, it was a bit of a buzz word. But it tends to happen naturally, there are physicists working with people in biology. I have got colleagues that work with the biologists up the hill and there are plenty of people working with engineers. So that happens naturally but I do not think you can sort of first principles create an interdisciplinary research field, it just happens.
>
> (Academic 42: physics, Go8)

Some of the physicists commented that interdisciplinarity was more common in and more suited to university-based research that involved collaboration with industry and 'where there is an applied outcome' (Academic 18: physics, Go8). Not surprisingly, these academics often worked in universities that placed a strong emphasis on close collaboration with local industry.

Others were greatly concerned about the loss of autonomy that results from attempts by the executive to prescribe interdisciplinarity from above, regardless of the motivations that may lay behind such top-down steering attempts. Resentment about being 'told' how and in what areas they should do their research were expressed even by those who had a favourable view of interdisciplinary forms of research:

> But I have done them [interdisciplinary research projects] on a basis of what works for me and my research program and what I find interesting, not on what my head of department or some professional research manager or the deputy vice chancellor or somebody has thought might be a good direction for me to go, or as part of some strategic plan that was decided in the university bureaucracy. And I would be very very opposed to being encouraged in one of those directions.
>
> (Academic 38: physics, Go8)

It is notable however that a number of areas mentioned by physicists as examples of good interdisciplinary research collaboration—climate science, bio-physics, materials science for example—are those also targeted in the so-called 'top down' initiatives by funding bodies and in institutionally established

interdisciplinary research institutes. At times, as we noted earlier, such resentment was related to experience that the conditions set up in this way did not work and that there needs to be more flexibility in also allowing for and supporting more open bottom-up initiatives. But at times too there did appear to be a level of in principle objection to any 'management' or outside involvement in directions for knowledge creation. In one sense this is naïve, in so far as research is dependent on funding which is always distributed in some way. However another way of seeing it is as a resonance of the strong and entrenched commitment to the peer community in the 'truth-seeking' disciplines and a conviction that these disciplines have over time shown an ability to successfully follow particular knowledge pursuits both disciplinary and interdisciplinary, a matter we come back to in Chap. 12.

Interdisciplinarity Pushes and Pulls

Those we interviewed had largely themselves been educated in disciplinary rather than interdisciplinary settings, and nostalgia for the past and for some golden age of greater academic autonomy can be heard in some interviews. But as critics and even advocates of disciplinary forms of organization have noted, academic life in the past was also replete with examples of 'god professors', sexism, jealousies and prejudices. Material, organisational and policy frames are always part of the conditions of academic work, and always authorise and advance some forms of work and careers at the expense of others. Similarly in terms of funding opportunities, in different interviews we heard some who saw interdisciplinary projects as unfairly advantaged, and others who saw these as disadvantaged because of the selection of assessors on disciplinary grounds. What we are attempting to show here is some of the specific issues interviewees identified in their current conditions of work.

Despite all the top-down pressures to engage in interdisciplinary forms of research, both historians and physicists alleged that the major Australian funding bodies, and the Australian Research Council (ARC) in particular, were generally ill-prepared to properly assess the merits of interdisciplinary research projects. They argued that this was due to the use of evaluation mechanisms set up in terms of a rigid disciplinary matrix.

> [The ARC] are totally incapable of dealing with interdisciplinarity […] because it [a grant proposal] goes to a discipline panel that is good at one thing or another, not both. With all of these organisations, with the funding rate of 20 per cent or less, they are looking to not fund, rather than to fund. The default is not to fund, and you are making it easier for them by giving them a whole bunch of stuff they don't understand.
>
> (Academic 19: Pro Vice Chancellor, Go8)

> We are not being well supported by the existing university research infrastructure and the [interdisciplinary] grant did very, very, very badly. As one of the reviewers said, this is neither research in physics nor is it research in programming. My point was, well no,

> indeed it is not, it is genuinely interdisciplinary, it is research in the overlap between both of them using the core business of either of them.
>
> (Academic 39: physics, Go8)

A historian observed that the ARC system of assessment of research grants, due to its reliance on the ABS 'Field of Research' codes created problems not merely for properly accommodating interdisciplinary research but also for the dynamically evolving discipline-based forms of research:

> I object to the way that ARC has its Field of Research codes… They are out of date, they do not reflect the shape of the discipline at all, and if you want to—when I look at them I try and fit my work in, I find it very hard.
>
> (Academic 20: history, Go8)[1]

So overall, there was a reasonably widespread perception both among historians and physicists that there was a contradiction built into the current governmental research funding system. On the one hand, interdisciplinarity was apparently encouraged and even prioritised due to its perceived benefits, yet on the other hand, current research funding mechanisms were based on old-fashioned and static conceptions of the structure and process of academic knowledge production (see also Bammer 2012).

The same critique extended to the government-generated 'Excellence in Research for Australia' (ERA) assessment initiative discussed in more detail in Chap. 4. ERA, one senior historian noted, harboured the same 'paradox of interdisciplinarity' (Weingart 2000) as the entire ARC funding system. He argued that the setup of ERA encouraged strategic behaviours at the institutional level that served to hide rather than to recognise interdisciplinary forms of research:

> One of my problems with that is the way research is funded actually goes completely against that stated objective […] Because I mean the impact of the ERA has been to make us concentrate our output, as it is called, our research outputs into certain research areas, certain research fields because that is the way we get the best results […] If your output is interdisciplinary and it is partly in history and partly in anthropology or partly in sociology and you declare your output 30% here, 30% there, 30% somewhere else, you are dispersing your asset, as it were, and you may not get a very good result. Whereas what we are trying to do now, here especially, is to get the historians to declare their work as historical studies, even if it is interdisciplinary, because that is the way we will get the best score. I mean this is the behaviour that the ERA has generated and it goes completely against recognising the value of interdisciplinary work.
>
> (Academic 20: history, Go8)

So there was some resentment amongst academics about being 'told' how and in what areas they should do their research especially as many felt that they did move in interdisciplinary directions if they saw a need for it. There was also some acknowledgement of reasons that it was being encouraged, such as the

[1]This issue of the FOR codes has been analysed in more detail in Woelert and Millar (2013).

requirement for universities to be producing applied research or engaging with industry.

As with the comments on the funding, we heard varying opinions on the pragmatic opportunities or difficulties of publishing interdisciplinary research. In history, as the earlier comment in relation to ERA suggests, at some universities historians are experiencing pressure to publish only in prestigious disciplinary contexts. Others too saw interdisciplinary work as hard to publish, in terms of finding appropriate journal outlets. Yet others took the contrary view, that interdisciplinary work was seen as much more exciting and publishable than non-interdisciplinary work.

For physics disciplinarity is generally seen as having more reliable and prestigious recognition, but if new lines of interdisciplinary research are beginning to emerge and to be recognised these can be seen as cutting edge in disciplinary contexts.

> So in terms of research, the interdisciplinary can have a lot of opportunities and I think that I got a lot of publications even during my PhD, partly because of my interdisciplinarity. I could submit to trauma studies, I could submit to history journals, cultural studies and I essentially published in all those kind of things so it was a big advantage.
>
> (Academic 26: history, non Go8)

> I think that increasingly the people who are getting jobs are the people who do not do interdisciplinary work […] Social history is easier to read, I think. A lot of social history, a lot of that kind of telling stories—gets more publications in my experience of it.
>
> (Academic 5: history, Go8)

Interdisciplinarity and Teaching

A number of universities across Australia have altered their curriculum to include a larger number of interdisciplinary programs and subjects. Often the reforms take place as part of a university-wide reform agenda, promoted as a form of curriculum renewal (in response to globalisation, new times, or for vocational or community relevance). However within university funding constraints these are also self-consciously developed as a way of changing the efficiencies of teaching in the undergraduate years, usually by reducing the number of overall subjects offered and having larger subjects with economies of scale.

Academics we interviewed do see benefits for students in having a broad understanding of the different types of knowledge that other disciplines offer.

> I mean I think it is a reasonable expectation that, general expectation, that people should be able to operate in a number of different discourses, right? […] I think those different skill bases help you learn different sorts of analytical skills and different styles of writing.
>
> (Academic 21: history, Go8)

And a number talked passionately about particular interdisciplinary topics such as climate change. They want students to be able to contribute to public discussions around some of these bigger and current issues in society.

Yet in talking of the curriculum reforms and their support for breadth or for some interdisciplinary subjects, our interviewees also made clear that they have some concerns about too much interdisciplinarity affecting or 'diluting' students' learning.

> If you are going to get your head around climate change, you need the basic physics.
>
> (Academic 3: physics, Go8)

> I think it's really important the students are given the discipline […] Discourse communities are significant and cannot be wished away by cross disciplinary thought. And I have taught too many subjects which are cross-disciplinary to think it is possible to actually do that. I think the disciplines exist because the generic rules that underpin them are real—and they are constructs of a lot of people's work over generations so […] it does not disappear overnight. However, I think once a student has become good at history or good at psychology or good at sociology, they are then in a position to draw on other disciplines very easily.
>
> (Academic 7: history, non Go8)

Many interviewees commented that interdisciplinary work was best done in the later years of undergraduate or at postgraduate and research levels. At these later years students have a stronger disciplinary understanding on which they can then build a deeper understanding of interdisciplinary areas.

> They need to understand the basics of the discipline they are majoring in, before you can actually talk about cross-disciplinary work.
>
> (Academic 34: history, Go8)

> In the intellectual sphere it is very helpful that people have an awareness of and a deep understanding of one particular discipline's way of thinking as their base […] That is a better basis for us to proceed on than trying to create a melded product at the undergraduate level. Because all you get then is mediocre physics or mediocre biology […] So the time for the collaborative, the interdisciplinary is at the postgraduate level, not at the undergraduate level.
>
> (Academic 4: physics, Go8)

This does not mean that they were against some inclusion of interdisciplinary subjects such as environmental studies at undergraduate level. They think there is a need for students to get some early exposure to a bigger field and types of questions that they might want to specialise in. The physicists made clear that they would also value humanities students having some exposure to this. But they do not want this to be at the expense of the specialist major.

Physicists often understood the undergraduate curriculum reforms as a response to the growth of knowledge in the sciences. Historians mainly saw these as being driven by financial imperatives, as being 'terribly, terribly market driven' (Academic 20: history, Go8). A number of the historians talked of changing

curriculum structures as being based on 'anything that will save money'. Instead of previous bottom up collaborations to develop new subjects with colleagues in other departments as new areas of interest emerged, they found themselves competing for a set number of slots in a pragmatically driven program:

> I think that [historians are concerned] partly because of that pragmatic nature of bringing interdisciplinary in, discussions internally and externally about how many units a major should have, and basically people feeling threatened in some ways that maybe that unit will not be offered. That possibly contributes to a siloing of disciplines as much as it contributes to merging disciplines in a productive way.
>
> (Academic 25: history, non Go8)

Some described how teaching within an interdisciplinary subject now means that they are required to emphasise what is specifically 'historical' about their approach (that is, to emphasise disciplinary boundaries more strongly than they would have in the past). And others saw the push towards larger generalist interdisciplinary programs as being linked to a focus on generic skills that is changing the substance of the teaching, and potentially undermining disciplinary teaching over subsequent years:

> We are driven more towards focusing upon the utility of what we teach. I prefer not to talk about disciplines in utilitarian terms. I would much rather talk about disciplines as being very sophisticated, well established ways of viewing the world through a particular perspective, or set of perspectives. Sometimes that suffers in the drive to create mass programs that have mass appeal that are focused upon vocational utilitarian outcomes.
>
> (Academic 29: history, Go8)

> If they have these generic faculty wide units in first year, and then they push us into say eight core units in second and third year [that] gives us effectively two years to try and teach someone from scratch how to be a budding historian. I do not like that idea personally. I would rather go the other way of having it from first year onwards. Have it content driven and discipline-based but along the way as I said, make sure that we cover all the generic skills that they need.
>
> (Academic 26: history, non Go8)

The setting up of interdisciplinary majors to attract students in what is seen to be a current and trendy topic appears to be a common occurrence in science related areas. Physicists in a number of universities were concerned with the difficulty of attracting students compared with other vocationally-directed lines of study that will pay better post-university, and it is often for this reason that specialist majors such as nanotechnology are introduced. However no one interviewed, even those who had experience in such courses or been recruited to set up such courses, thought that a course structured wholly in terms of a contemporary problem-focused issue or new form of interdisciplinarity such as biophysics or big data was a satisfactory replacement for a disciplinary major. These types of programs were seen to produce a temporary upsurge of student demand, that falls away as other things become fashionable (i.e. the market rationale is not sustained); and

believe the structure does not give the 'problem portable' foundations of a more traditional physics degree.

> There are many important questions in biophysics. But you have to be very careful about expecting or taking a student into an area like that, because then […] you find that in the end they do not have training in either. Whereas the more successful interdisciplinary scientists have always come from one field, because they have a very good understanding of one field, then they can get a knowledge of the other field […] and that is when the better discoveries are made.
>
> (Academic 12: physics, Go8)

> So a lot of these nanotechnology courses started probably as undergraduate courses. We had one here. The students come in. They do a little bit of physics, a little bit of chemistry, a little bit of biology, a little bit of material science. And what ultimately happens is at the end they come out and they are jacks-of-all-trades and masters of none.
>
> (Academic 23: physics, Go8)

Conclusion

The physicists and historians interviewed in this project have many experiences of interdisciplinary teaching and research, and see a number of reasons why it is emerging and where it has value. But the majority of them also believe that disciplinary training and identification is important as a foundation for interdisciplinary pursuits. Interdisciplinarity is something they see as most effectively occurring 'organically', and many of those we interviewed have in fact ended up in interdisciplinary fields. However they resent the external manipulations that attempt to mandate interdisciplinary work, and some also consider the current focus on interdisciplinarity per se to be driven by fashion. In the case of research, they object to funding schemes that in their view artificially either preference interdisciplinary work, or work against interdisciplinary work; and to a superficial policy rhetoric that identifies only explicitly interdisciplinary work as cutting edge.

In almost all cases they see some disciplinary 'insiderness' as a pre-requisite to strong creative interdisciplinary work as well as to innovation within the discipline. Even physicists who had been recruited to set up new courses in nanotechnology, now voice some misgivings about structuring the undergraduate curriculum in this way rather than via the more 'problem portable' structure of physics. However physicists did see the need for broader non-specialist knowledge as well as physics knowledge as an important part of undergraduate education. But they see the role of physicists in interdisciplinary work is to act as physicists.

History offers a different kind of take on the current push to reform the undergraduate curriculum. As a discipline, history freely draws on theories from other disciplines, but when forced into a template undergraduate curriculum that requires interdisciplinarity of a certain form, they are forced to be narrower: to

make their contribution a demonstration of the value of a specifically historical approach. They see losses of good will in some new interdisciplinary collaborations stemming from the competition for students between different departments, and they are cynical about much of the current curriculum reforms which they see as primarily a cost-cutting exercise.

References

Abbott, A. (2001). *Chaos of disciplines*. Chicago: The University of Chicago Press.

Bammer, G. (2012). *Strengthening interdisciplinary research: What it is, what it does, how it does it, and how it is supported.* Canberra: Australian Council of Learned Academies (ACOLA) Report. Retrieved from http://www.acola.org.au/PDF/Strengthening%20Interdisciplinary%20Research.pdf

Klein, J. T. (1996). *Crossing boundaries, knowledge, disciplinarities, interdisciplinarities*. Charlottesville: University of Virginia Press.

Klein, J. T. (2000). A conceptual vocabulary of interdisciplinary science. In P. Weingart & N. Stehr (Eds.), *Practising interdisciplinarity* (pp. 3–24). Toronto: University of Toronto Press.

Jacobs, J. A., & Frickel, S. (2009). Interdisciplinarity: A critical assessment. *Annual Review of Sociology, 35*, 43–65.

van Leeuwen, T., & Tijssen, R. (2000). Interdisciplinary dynamics of modern science: Analysis of cross-disciplinary citation flows. *Research Evaluation, 9*(3), 183–187.

Weingart, P. (2000). Interdisciplinarity: The paradoxical discourse. In P. Weingart & N. Stehr (Eds.), *Practising interdisciplinarity* (pp. 25–41). Toronto: University of Toronto Press.

Woelert, P., & Millar, V. (2013). The 'paradox of interdisciplinarity' in Australian research governance. *Higher Education, 66*(6), 755–767.

Chapter 11
Performance Measurement and Management

Academic work at Australian universities today takes place against a dramatically transformed policy and governance context compared to a few decades ago. As outlined previously in Chap. 4, over the last few decades Australian universities have been subjected to an increased form of performance-based control by federal government and to repeated cuts in governmental funding, yet they and their executive core have also gained greater managerial autonomy. In the internal governance of the university, formal performance measurement and management systems have attained a central role, and have given rise to an institutional 'audit culture' emphasising regular assessment of performances and performance-based forms of accountability and control.

In this chapter we address the question of how academics working in the disciplines of history and physics perceive and negotiate on the ground this new regime of performance-based control. We explore the view these academics have of the system of performance-based accountabilities existing at their universities, their perception of the specific institutional mechanisms being used for the assessment purposes, and how they think that these mechanisms are influencing and impacting upon academic work.

New Forms of Accountability

The academics we interviewed widely recognised that performance-based accountabilities are now part and parcel of academic work. They were accepting in general terms of some conception of accountability and the idea of 'answerability for performance' (Romzek 2000, 22). Most were also broadly receptive to the idea that they ought to be accountable to the public which ultimately funds their work. And yet, as we will outline in more detail below, there was widespread

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criticism that some of the specific accountability mechanisms employed at universities today were blunt and distorting, and ultimately had a deleterious effect on the quality of academic work and the efficacy of universities as knowledge institutions more broadly.

The view that there should be proper checks and balances for academic work was often voiced, and extended both to proper conduct and to broader results of knowledge activities. The statement of one senior historian is indicative:

> I think accountability, you cannot argue with accountability. I mean why should we not be accountable for what we are doing, I mean we are accountable for the teaching all the time, we should be probably more accountable for the research than we are, it is inevitable that we should have to do, we are using public funds, partly public funds at any rate. It is inevitable that we should have to account for how they are used, it is inevitable that we should be asked to produce results, I do not have any objection to that. I mean it is just normal.
>
> (Academic 20: history, Go8).

Similarly, a more junior historian observed that there was nothing problematic about accountability per se, warning of any one-sided nostalgia about the past: 'In the old days of course, there was zero accountability, and there were quite a few academics in the hammock' (Academic 34: history, Go8).

Yet alongside this broader acceptance of the idea of accountability, the historians and physicists also expressed some reservations with regard to the actual accountability pressures they are subjected to at their institutions. Two concerns stand out. One relates to the use of managerial mechanisms of accountability rather than those that derive their legitimacy from the judgement of academic experts. The other concerns the actual effects of the expansion of managerial accountability systems on academic work and on universities more generally.

A first irritation was that the recent rhetoric of accountability and the institutional practices it sustains gloss over the fact that academic work is already regularly subjected to many critical evaluations:

> It is evaluated constantly, all academics' work. Especially in the humanities, it is being constantly evaluated. Every time we send a draft of an article to a journal, or every time we write a book, every time we apply for tenure, every time we apply for a promotion, and then every year we have a performance development assessment interview, and so every—we kind of put our work out there all the time to be judged.
>
> (Academic 20: history, Go8).

Some saw the newer, managerial forms of accountability as clashing with and potentially undermining long-established professional forms of accountability and recognition:

> And so I think—some universities have a much tighter appraisal structure and performance management structure. […] And I do not think that you need it to be a responsible professional. I actually think that that is an unfortunate construct that gets placed upon a lot of people. It is more about cultivating the responsibility and the commitment among staff […] than creating an accountability structure and then forcing compliance which I think is the bad way to go about things.
>
> (Academic 29: history, non-Go8).

There also was considerable concern that the managerial accountability requirements at universities had led to a significant administrative workload increase that was detrimental to the core academic work in research and teaching. Participants reported that the administrative burden stemming from various reporting requirements had increased considerably over recent times—a phenomenon referred to in the literature as 'academic' bureaucratisation (Coccia 2009):

> I have spent the majority of my time dealing with administrative processes […], introducing major changes in the way we use space because our future prosperity will not be determined by how many Nobel Prizes we win but by how much space we return to the centre. […] And I think probably the external scrutiny of our activities, is probably the biggest change in the past two decades, I would say. The fact that we are much more highly assessed and accountable for what we do is a major change.
>
> (Academic 3: physics, Go8).

> I have calculated last year the amount of time that I spent on all kinds of paperwork and it was at the very least three to four months. That is massive. […] In the beginning there was far less of it, you had more time. To me it seems that increasingly, because many of these bureaucrats and administrators are not academics and it seems to me that they define the principle of accountability in terms of they see our time as a commodity and in the worst case as a void that they need to fill. They need to regulate and they need to control in every possible respect, and that I think has, well ultimately nefarious consequences in terms of both time and also the quality of your work.
>
> (Academic 34: history, Go8).

This said, there were some specific areas of academic work where the increase in accountability, including its more managerial variants, was regarded more positively. A number of participants, both junior and senior, welcomed the increase in formal accountability in the supervision of doctoral students. A historian observed that this increase was necessary given recent changes to the perceived purpose of the PhD as well as to the associated funding mechanisms. In the old days, he observed, in the humanities at least, the PhD was widely seen as a 'kind of major work' that was 'going to shape a whole career', whereas in the present it is more widely regarded as 'just a bit of training you have to go through' (Academic 20: history, Go8). In the old days, too, the supervisory relationship was characterised by a somewhat 'leisurely approach':

> You'd meet occasionally [with the student you supervised] and have a very civilised discussion about the project, […] as though there was no pressure on.
>
> (Academic 20: history, Go8).

As a result (in this field of history) it was not uncommon that a PhD thesis took up to seven or eight years to be completed, and there was little emphasis on the publication of research findings outside of the thesis.

These days, the same academic noted, a considerable accountability focus and funding implications are placed on timely completion and on doctoral students' research productivity, and this was not necessarily 'a terribly bad thing' (Academic 20: history, Go8). He commented that the old model of research supervision was no longer well suited to assisting doctoral students in building their academic

careers in an environment that was now much more competitive. But he recognised that not all his colleagues were similarly sanguine about the new modes:

> As long as students and supervisors still see it in the old, traditional way, then there is a tension between their attitude and the attitude of the funding bodies and of the university.
>
> (Academic 20: history, Go8).

Another more junior historian was of the view that lack of external scrutiny and accountability pressures characterising the traditional supervisory model meant that students were actually often neglected by their supervisors:

> I came in when accountability was already established, where you had reviews, where there was an understanding that you should meet with your students. I actually think there should be more intervention. […] I think there should be formal requirements as to what supervisors do […] I think that they should all—I think there should be a clear understanding of what was required by that relationship because, you know, too many students get neglected. […] I think accountability is good.
>
> (Academic 21: history, Go8).

The increase in accountability in the supervision space was also welcomed by many of the physicists we spoke to. One senior physicist, who was otherwise quite critical of management directives, noted:

> So I have noticed here in particular, there has been a lot more of an emphasis on good research supervision and on progress reviews and on PhD confirmation. And it is actually quite well set up in this school and I think it works well. So there is a good chance to assess the student and also the supervisor and I think that is really important. […] So I am really glad that there is that emphasis on students. It is changed, there is more emphasis on it, and it is in the last few years and it is a good thing.
>
> (Academic 42: physics, Go8).

Others noted drawbacks resulting from the increased accountability focus on timely completion of doctoral students. A physicist commented that the pressures to complete students within three years increased the risk that some students had not yet reached the desired standard when graduating:

> And there is a shift in the sector now to do PhDs in three years. I actually had an email from the administrator at the university saying to me, "A PhD at [this university] is three years. We make that clear to our students on admission." […] You often end up with graduates that are good and would make great PhDs but they have to go [yet are] not quite ready to go either. So I have had students where, if you push them out after three years with a PhD, they are not quite ready to go.
>
> (Academic 23: physics, Go8).

He also saw the new accountability pressures as creating a disincentive for allocating talented doctoral students to research projects that are quite challenging and risky:

> You end up not offering—you end up trying to not offer students challenging projects anymore, because you know that there is a risk that the university will try to throw them out before they manage to finish them. […].So if you want to go after the hard things in

> your research, it becomes harder to do. You cannot offer students what can be possibly slightly riskier but slightly higher return projects if they come off.
>
> (Academic 42: physics, Go8).

Trends in Performance Measurement and Management

Almost uniformly the academics identified the proliferation of numerical indicators and metrics for assessing research and teaching activities as the major change that had taken place at their universities. This finding is interesting given that we drew our interview cohort from two diverse disciplines, diverse university locations geographically, and diverse types of institutions.

The proliferation of generic performance metrics was seen to be particularly pronounced in the formal assessment of academics' research performances. Interestingly, it was the physicists who seemed almost perplexed about the extent of this 'metric tide' (Wilsdon et al. 2015). For example, a senior physicist noted a 'tremendous drive to put a number to everything' in the assessment of individual performances at his institution (Academic 32: physics, Go8). Another physicist took particular issue with how the increasing obsession with research metrics at his institution led to distorted perceptions of the purpose of research:

> …and the metrics now have gone absolutely berserk in terms of research, you know with ERA and everything. Everything now is focused down on those KPIs [Key Performance Indicators] […] I think it is ridiculous that there is this sort of blinkered view of that is what the world is all about, you must publish papers, you must meet these KPIs. […] I think in a lot of people's minds objectives and outcomes have been replaced by KPIs. The KPIs are just a measure of an outcome, of trying to achieve an objective, and in my mind, in research terms the objective is simple, to do high quality, impacting research.
>
> (Academic 40: physics, non-Go8).

One consequence of this increasingly narrow focus on metrics in this assessment of research performance was that the scope for 'qualitative assessments of quality based on reputation', or use of more selective and in-depth assessment methods such as peer-review was increasingly diminishing:

> So, now all of your research grants, essentially, come down to how many papers you have produced. What your H-index is. A paper that you write in a journal with high impact factor is as far as that is concerned is better than a paper that you might write in a low impact factor journal.
>
> (Academic 23: physics, Go8).

Summing up the general trend one physicist concludes:

> You are assessed – yes look, we are in a bean-counting world at the moment so people like things that are easily quantified. So they can quantify number of papers, they can quantify the quality of the journal in which those papers are published, they can quantify citations to the papers so all of those things are looked at very carefully.
>
> (Academic 13: physics, Go8).

It was interesting that the physicists —who are particularly familiar with working with sophisticated quantitative methods—expressed their unease about the increasingly narrow assessment focus on metrics such as number of publications or citations.

To clarify, there was no general opposition in these interviews to the use of research metrics per se. The physicists repeatedly stressed that specific research metrics can be useful as part of performance assessment, or to make an informed decision about appointments. But they voiced a number of concerns about current institutional uses of these metrics, some of which mirror concerns raised by leading experts in research metrics (e.g. Hicks et al. 2015).

One issue is the diminishing scope for substantive-focused assessment methods via peer-review. The consensus among the physicists was that such qualitative assessments were important to complement metrics-based forms of assessment. There was also recognition that informal 'verbal evaluations' by peers were 'very important' (Academic 13: physics, Go8). Not surprisingly, many of the historians we interviewed were even more critical than the physicists in their reaction to the blunt imposition of research performance metrics, which for them was a relatively new phenomenon. Their conviction was that peer-review is 'the best method of assessment' (Academic 20: history, Go8).

A related concern expressed by the physicists was that performance metrics within Australian universities are often applied without 'suitable interpretation and suitable averaging and a suitably intelligent interpretation of the data' (Academic 13: physics, Go8). Citation metrics were singled out in this context as they were seen to be severely distorted by 'fashions and fads for things':

> So what our system does not capture very well is the importance of papers. It uses citations to gauge impact, and it equates impact with importance. And sometimes it is, and sometimes it is not.
>
> (Academic 13: physics, Go8).

Distortions in the use of research metrics were also mentioned by the historians. An early-career historian working at a research-intensive university took particular issue with taking raw publication counts as a generic proxy measure for research performance across disciplines, as this institutional practice discriminated against fields where 'high quality, high density stuff' and lengthy publications were the gold standard:

> I just finished an article. It took me two years to write it. Of about 20,000 words, for [an international] most prestigious review […]. It is a 50 page, double whopper. It is on something that has not been studied before and it will be cited for a long time to come, […] What does it get me here? It gets me one abstract point. As opposed to colleagues for example who publish a thousand words in five articles and get five points.
>
> (Academic 34: history, Go8).

Exacerbating the problem for this particular academic was the institutional practice of translating the achieved publication 'outputs' into 'workload points' which were used in allocating workloads to individual academics for the following year:

> Our workload is calculated on the base of what you did the previous year. One article equals, I do not know, 50, 100 points. I do not know. Frankly, I do not care. But again if I had the five points [from publishing five shorter articles rather than one very long one], I would get five times those workload points. So every year, at the beginning of the year, I am almost in trouble that I will not meet my workload […]. So that is the reality.
>
> (Academic 34: history, Go8).

In regard to the formal assessment of teaching, there was some acknowledgement among the academics we interviewed that teaching evaluations by students can be useful. The perceived value of these evaluations was that they allowed for inferences about one's own teaching style and where to make improvements, though with many adding the reservation that this is the case only if evaluations were carefully designed and implemented. Against this backdrop, it is not surprising that some academics took issue with what they identified as a trend toward more metric-based and generic forms of evaluation of teaching activities. Some linked this trend directly to centralisation tendencies in the management of academic work.

A physicist pointed out the recent emphasis on more generic teaching measures at his institution reduced the potential usefulness of the collected data to foster professional development and learning locally. He reported that prior to the establishment of a uniform teaching evaluation mechanism covering the entire university, departments had some discretion over how to design student evaluation forms:

> It allowed the teachers to put their own questions in and so you could use it to find out how experiments in your teaching style had gone. We do not have that option anymore. […] The fact that you impose a generalised instrument across the campus means that it is not as good as the highly specific ones that we had for physics in the old days. So I guess we now have a cruder instrument that is a bit more machine-readable and more quantitative.
>
> (Academic 22: physics, Go8).

The sentiment that generic formal evaluations of teaching were of limited practical value was quite frequently expressed.

> Somebody happily announced some time ago a teaching index and I have got no idea what it is called. I have no idea if I have got one. So you can see my level of belief in that sort of number.
>
> (Academic 32: physics, Go8).

> I always score relatively well so it is quite nice like that, but it does not really give an indication of what you are doing, it gives an indication of how happy the students are, not necessarily what they are learning. And I would like it to be more based on outcomes, but again, there are all sorts of issues about how you reasonably measure those without causing additional stress and making things go downhill.
>
> (Academic 36: physics, Go8).

The physicists were particularly outspoken in their disdain for these forms of teaching evaluation. However it should also be noted that a number of physicists

also acknowledged elsewhere in the interviews that for physicists and physics departments, research and not teaching has always been the main game.

A historian also observed that student evaluations of teaching can be unreliable and distorted due to the fact that the participation in these evaluations was often skewed:

> You have got to show that students like you which is problematic here because students do not have to fill out their forms. So you only get the people who love you or hate you.
>
> (Academic 21: history, Go8).

Overall, these views on the evaluation of both research and teaching suggest that there are considerable frictions existing between the preferences of 'managerial' and 'professional' approaches to performance measurement and management running through Australian universities today. As one physicist remarked, 'what the upper levels in the university think are desirable criteria won't necessarily match with the desirable criteria looking from the bottom up' (Academic 46: physics, non-Go8).

So, on the one hand, the academics we interviewed noted a proliferation of generic performance metrics that can be applied uniformly across the entire university. In the literature this is generally regarded as indicative of managerial regimes that favour more centralised, top-down and punitive forms of steering (see Carter et al. 1992). On the other hand, most of the academics indicated their preference for a professional style of assessment that does justice to the complexities of their work. In their view, proper assessments of academic work ought to retain scope for qualitative judgements that are informed by domain-specific expertise, and should mainly be driven by the aim to facilitate processes of professional learning and development.

Perceptions of Effects

The academics interviewed offered views suggesting that performance measurement and management practices had reconfigured not only the institutional space in which they work but also, at least to some extent, academic work itself. Many tacitly acknowledged their own responsivity to the major performance indicators and metrics used by universities today, although they generally stopped short of admitting allowing strategic forms of response to dominate their research and teaching aims. They were more likely to comment on colleagues whom they saw as responding in that strategic fashion. More junior staff and casual staff were also more likely to offer comments about their own relative powerlessness compared with more established colleagues to resist the new forms of performance management.

From our interviews it is clear that although a trend to more generic and centralised performance management was taking place across the country, the actual impact of the processes at department level was not uniform. We begin with some

examples where the changes to this point seem to produce relatively little effect on practice or substantive academic work; and then turn to some areas where effects were being noted.

Sometimes formal performance assessment and management processes were seen as being essentially a window-dressing exercise with little relation to the actual work taking place. For example, one historian regarded the annual performance review as an 'administrative paper pushing exercise' that exists 'so the administration can say yes we have done this, yes we have a performance review system in place' (Academic 45: history, non-Go8). This aligns with the observation made by Meyer and Rowan in a classic sociological paper that organisations may formally adopt 'ceremonial' measures and undertake 'ceremonial' performance assessments that are decoupled from actual organisational practices, but which serve to produce legitimacy vis-à-vis the external environment (Meyer and Rowan 1977, 350–351; see also Townley 1997).

Not surprisingly, the perception here was that if performance management practices were maintained mainly for ceremonial reasons, then this meant they had little actual effect on individual academics other than contributing to administrative load. Two senior academics—both with past or present leadership responsibilities at the departmental or faculty level—explicitly expressed their frustration with this state of affairs. The first comment is from a physicist, the second from a historian:

> Part of it is because the university does not take normal annual professional development seriously. It runs a process but it is an electronic box ticking exercise as opposed to something that is taken properly and seriously. Colleagues who are slack on teaching do not get increments denied, do not get performance demerits […] If you are not doing a good job on research, well then you just simply do not get promoted.
>
> (Academic 39: physics, Go8).

> And the performance development reviews, well – the problem with those is that there are no consequences for [them] — good performance is not rewarded and bad performance is not sanctioned. I mean so it does not really matter, it is hard to – and one or two people find it hard to take them seriously as a result. […] If you have a terrific performance record for two or three years running, do you get a bonus? No, you do not. If you have a lousy one for two or three years running, is there any come back? No, there is not, not really.
>
> (Academic 20: history, Go8).

Another experience of such decoupling of formal processes from actual activities was mentioned in relation to setting of individual performance targets. In line with previous findings concerning target-setting in areas of public management (see Bevan and Hood 2006; Hood 2006), there were indications that the actual practice of setting targets at Australian universities was quite divorced from the purported rationale behind the use of targets systems. The story of one junior historian is illuminating:

> The way my mind operates is that I like to set myself extremely high goals, the old reach for the stars and if you miss then at least you are still extremely high, that sort of thing.

> So I set out all these which were probably outlandish aims, and then I was tapped on the shoulder and sort of said, oh look, you maybe want to reassess this because the way that this actually works is that if you set out your aims as your planning and then your performance is marked against it, if you do not achieve them all you are actually ranked down as your outcome. What you are better off doing is with your planning not putting too much into it, just enough, and then if you can cover that and then some then your ranking is outstanding.
>
> (Academic 26: history, non Go8).

However the majority of the academics we interviewed appeared to take the performance measurement and management mechanisms existing at their university relatively seriously, either because they feared the constraining impact these mechanisms could have upon their own academic work and career, or because they saw in them an opportunity to advance their own position. They also frequently suggested that these mechanisms stimulated a range of strategic adaptive behaviours by academics working at Australian universities, particularly as concerns research activities.

A range of academics we interviewed reported that the strong emphasis on countable publication outputs in the Australian system has led them to 'play it safe' by consciously avoiding riskier and more long-term but also potentially more rewarding lines of research. As one senior physicist summed it up:

> You need to produce a certain amount of research, so it has to be a sufficiently safe in that you can predict at the outset that the grant is going to fund work that is doable and produce a result. There might be targets in science that are actually much more interesting and fundamentally significant, that you would not have a go at because you have got to keep publishing or perish.
>
> (Academic 42: physics, Go8).

Others reported that they avoided interdisciplinary research projects as these are likewise perceived to be risky in view of the ways in which the major research funding and performance evaluation mechanisms in Australia were structured around disciplinary classifications (see on this point also Woelert and Millar 2013). This concern regarding interdisciplinary research was shared by both historians and physicists.

Several academics noted the benefits from strategically aligning their own research agenda with topics that may be less interesting to them personally but were perceived to be 'hot':

> If I was strategic I would probably be really pursuing a project on the environment that I was invited to because there is potentially a lot of funding in that area.
>
> (Academic 25: history, non Go8).

The interviews also alluded to more insidious forms of strategic response that involved the 'gaming' of specific performance measures. Academics can artificially inflate the number of their research publication outputs by publishing 'piecemeal' publications, that is, small units of publications instead of a single comprehensive piece, or by rehashing previously published content with only slight modification:

> I certainly see, I certainly reviewed in recent times papers that are very similar to something else in the scripts, published with minor changes, in what I would see as an attempt to increase the number of publications. […] Instead of putting together one big publication that has a lot of stuff in it, there is a drive more and more to break it down into smaller publications because with each publication well, you have got another publication and you have got more chance of a citation and so I would say yes, that drive to put a number to everything has a flow on effect in a range of ways.
>
> (Academic 32: physics, Go8).

Some criticised colleagues whom they saw as achieving a higher number of publication outputs through sacrificing the quality of their publications:

> There are other people that will just push out whatever dross they can get together so they have high publication counts. And, people know that but the metrics hide that quality aspect of research. It is the same problem across the board.
>
> (Academic 23: physics, Go8).

Finally, various academics we spoke to highlighted the strategic potential of co-authorship. That co-authorship may serve as an effective strategy to boost one's publication numbers was emphasised by the participating physicists. They acknowledged that the number of authors of papers in their field had increased due to the large-scale, collaborative nature of much of contemporary research. But some at least were also adamant that this increase was also in part motivated by more strategic concerns:

> There is quite a game now trying to get yourself in collaboration so you can get on a paper, so that you have twenty papers even though you've only done the same amount of work you'd normally do. […]. You know you've got to be doing collaborative work so there will be six of you writing papers—there will be six times as many names on them.
>
> (Academic 43: physics, Go8).

> You see CVs of scientists who have 500 papers. Whenever I see that, I know that they are very good at collaborating with other people. That is what it tells me. Or they are a lab director or something like that.
>
> (Academic 13: physics, Go8).

The strategic potential of co-authorship activities in the current climate at Australian universities was also recognised among the historians. Yet among this group, the long established, discipline-specific emphasis on individual authorship constrained the extent to which such strategy was considered viable:

> There is an emphasis on the opportunities involved in co-authorship, we think we could probably increase our productivity with co-authoring. But there is still a humanities emphasis on sole authored articles being the benchmark.
>
> (Academic 49: history, Go8).

A number of academics pointed out that performance management frameworks within their universities, along with the highly competitive research funding schemes that emphasize 'track record', both tend to create an incentive to prioritise their research through finding ways of disengaging from teaching. This

reinforces a split between teaching and research domains and activities that was widely conceived to be damaging. One ambitious, younger historian for example noted that the current performance appraisal system at her institution—a research intensive university—made her prioritise her research over her engagement with teaching, not out of conviction but out of the career rewards this offered:

> I find myself strategising to try and limit my engagement with teaching but to nevertheless do what is necessary. To find lower maintenance ways to get involved in service is my next project. But, so we all do that. You need to balance and the more career oriented you are the more finely you have to do that equation.
>
> (Academic 21: history, Go8).

Another historian saw this tendency to disengage from teaching as being a consequence of the broader design and incentive structure of the Australian research grant system:

> I cannot stand the ARC [Australian Research Council] system where some people can carve out careers purely on research. I come from the United States where even the big superstar professors, they all teach.
>
> (Academic 44: history, non-Go8).

Conclusion

Although universities use teaching evaluations, and although these quality teaching scores are commonly included as criteria in individual annual performance reviews and assessments for promotion, our interviewees mentioned much more often the impacts of research performance measurement on their activities than they did the impact of teaching performance measurement. This may reflect in part the higher reputational rewards that continue to be associated with research, particularly in the two established fields from which the participating academics were sourced. Yet, recalling our previous discussion in Chap. 4, it is also likely to derive at least partially from the fact that performance-based funding mechanisms in Australia primarily concern universities' research activities and the associated outputs. This results in the particular incentive for universities to emphasise research productivity in their individual level performance frameworks, and for individual academics it results in the associated incentive to make research the main target domain of individual strategising.

In this chapter we have been conveying the kinds of responses we received when we asked open-ended questions about the work historians and physicists were doing today and their perceptions about what has changed and with what effect. We showed that across institutional contexts they widely perceived trends towards increased processes of accountability via quantified performance measurement and management, derived from, and produced for use by, managers outside the local department or faculty. Overall the interviewees suggested not a blanket opposition to the idea of accountability and the associated mechanisms,

but rather a more nuanced criticism that the balance had tipped too far in the direction of reliance on quantified measures, and the use of managerial compared with professional forms of evaluation. In terms of how new criteria were changing their practices, they were broadly supportive of the recent development of more oversight of the doctoral phase, though some lamented that this represents a decisive move to see that phase, in more risk-adverse terms, as 'research training' rather than as a genuine opportunity for the production of new knowledge.

In terms of performance management in different institutions, there was some variation reported in relation to whether changes are experienced as mechanisms that drive new practices as compared with having merely ceremonial effects. Interviewees see the focus on research metrics as producing some tacit incentive to reduce time spent on teaching. They freely offered examples of how people (usually others rather than themselves) might game their activities, to produce a higher apparent quantity of output by using co-authorships and by reducing quality and scale of each publication. In the interviews the physicists and historians talked more about the ways in which metrics such as citation data can be misleading measures of quality and research importance than about ways these can be some proxy for these. Similarly they talked relatively little about the academic peer review that still strongly operates via journal publication, grant assessment, and in appointments and promotions via committees and referees. Their focus was more on what they were experiencing as changing than on the continuities, and more on external assessments of performance than on those occurring within the disciplines.

References

Bevan, G., & Hood, C. (2006). What's measured is what matters: Targets and gaming in the English public health care system. *Public Administration, 84*(3), 517–538.

Carter, N., Klein, R., & Day, P. (1992). *How organisations measure success: The use of performance indicators in government*. London: Routledge.

Coccia, M. (2009). Bureaucratization in public research institutions. *Minerva: A Review of Science, Learning and Policy*, *47*(1), 31–50.

Hicks, D., Wouters, P., Waltman, L., de Rijcke, S., & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. *Nature, 520*(7548), 429–431.

Hood, C. (2006). Gaming in targetworld: The targets approach to managing British public services. *Public Administration Review, 66*(4), 515–521.

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363.

Romzek, B. (2000). Dynamics of public sector accountability in an era of reform. *International Review of Administrative Sciences, 66*(1), 21–44.

Townley, B. (1997). The institutional logic of performance appraisal. *Organization Studies, 18*(2), 261–285.

Wilsdon, J., et al. (2015). *The metric tide: report of the independent review of the role of metrics in research assessment and management*. Higher Education Funding Council for England (HEFCE). Retrieved from http://www.hefce.ac.uk/rsrch/metrics/

Woelert, P., & Millar, V. (2013). The 'paradox of interdisciplinarity' in Australian research governance. *Higher Education, 66*(6), 755–767.

Part V
Knowledge, Disciplinarity and the Future

Chapter 12
Regulation and Governance in Australia: Implications for Knowledge Work

The discussions in this book have highlighted various regulatory and governance dynamics shaping the institutional context in which teachers and academics in two core disciplines in Australian schools and universities conduct their work. For universities, sweeping changes in federal policy arrangements over recent decades have resulted in increasingly intricate performance reporting and accountability requirements as well as a progressive reduction in reliable public revenue streams, thus creating an increasingly complex, uncertain and competitive environment for academic work. For schools, the stronger regulation of curricula at the national level rather than at the state level, the development of new public comparisons inside and outside Australia and the associated testing programs and increased governance emphasis on institutional competition and individual choice have all fed into the environment in which teachers do their work.

Our previous chapters indicate that these changes in regulatory and governance settings have had some direct implications for the ways in which formal educational and research activities are rationalised and conducted at the institutional and individual levels. But while there appear to be some common traits and motifs in the political dynamics surrounding the work of both schools and universities, the actual implications of these can only be properly understood by taking account of differences in mission, scale and complexity between both types of institutions. Our discussions have shown that a specific managerial style of performance-based accountability is now present in both schools and universities, operationalised through formal and regular assessments of the work of academics, or of entire schools and universities, and relying in the process on a set of generic, quantifiable criteria or standards that lend themselves easily to comparisons across various domains and institutions. But the extent and form of this management and accountability—and how it is seen and experienced by teachers and academics on the ground—varies both between the two sectors, and between different institutions in each sector.

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Public Transparency, Comparison and Ranking

In the case of the two major governmental initiatives for assessment of school-based learning and university-based research activities, NAPLAN and ERA, the results attained are made publically available so that rankings and comparisons can be constructed on their basis. As a result, both schools and universities take the reputational implications resulting from these initiatives very seriously, as well as any potential flow-on effects on funding.

In universities, we found a range of indications that they have in the main responded to the reputational and financial pressures resulting from governmental research assessments and funding schemes by internally replicating the performance measures used by government. This top-down dynamic in several institutions extended to the performance evaluation of individual academic staff, with generic performance measures established in macro-level policy contexts being directly applied, in quite undiscerning ways, to the work of individual academics.

In schools, the link between government performance assessments of entire institutions and the evaluations of the work of individual teachers appears to be less direct. The regulation and governance here have taken the form of moves to establish a detailed new framework for curriculum in schools, the establishment of new bodies to oversee this, and the building of a public website to display comparative data about schools. Unlike in the USA, student performance data is not commonly used as an employment criterion of teachers. Nevertheless, as we discuss further below, there were a range of indications that the testing outcomes are felt to implicitly shape the culture and priorities of schools, and conditions for subjects such as history and physics that, in the instance of NAPLAN at least, may not be at the heart of the testing agenda.

Our analyses of the interview data identified a range of concerns about these developments and the effect they have on knowledge work. In the majority of cases, this did not amount to a blanket opposition to new forms of accountability per se. Similarly, there was seldom a generic refusal of the idea of subjecting the work of teachers and academics to some testing and measurement. Rather, the teachers and academics we spoke to took issue with the fact that the forms of assessment and testing that are preferred by governments and managerial strata of institutions do not account properly for specific local conditions and traditions in which knowledge activities are situated, are not well suited to building capacity on the ground, and tend to be oblivious to unintended effects they may have.

Schools and Testing

A concern among a number of teachers was that the strong publicity and political emphasis placed on large-scale tests such as NAPLAN made the task of inspiring students in education more difficult. They saw NAPLAN, along with the increasing competition for high ATAR scores in year 12, as producing a drive to a particular form of learning for the examination which limits how the content and purpose of school subjects are experienced. It is not just that the things that are measured reportedly begin to occupy too much the space in the curriculum; and not just that too much time is being spent on things that can be measured, but that students too internalise the orientation toward 'measurement by numbers' rather than seeing education as a substantive and constructive activity. Some of our interviewees noted that in the senior years, students have become increasingly savvy in gaming their subject choices to achieve the highest possible score, even if that leads to dropping subjects they see as relevant or that they have a substantial interest in. In this project a number of teachers from one state in particular voiced their concerns about history losing popularity because it takes more time-consuming work to produce a similar score outcome than another subject.

For schools, the cascading of not just testing but a particular kind of education performance (through global, government, institution, teacher and student practices) was commented on by many of those we interviewed. As one of us suggested in an earlier article related to this project:

> National governments have been 'galvanized' (to use one Australian Prime Minister's word) by concerns and fears about a global competition of schools and they have become adherents of a faith in testing and ranking mechanisms as the authoritative story of what schools and students are achieving. […]
>
> [T]ests are the carrier rather than the driver of the philosophy of 'new public management'. They are one way of producing benchmarks for comparative performance appraisal, and for providing 'evidence' of claims of improvement. And they are a convenient measure for assessing teacher performance and accountability (though not the only measure – student attitude surveys are also being widely used in Australia to measure quality of teaching). The way to know a system is working is to measure and count again and again. What matters is the scores. And equally, what accompanies this (at least in the USA and in Australia, I think it is less apparent in Scandinavian countries) is a distrust in professionals and professional judgment (Power 1997). The result is that the role of education to inspire, open up, encourage, is little talked about, and governments find ways to sideline the experience of teachers because they are not impartial advocates. And education becomes a mechanism for producing measurable outcomes, so that politicians can provide 'evidence' that their systems have improved, or alternatively berate countries like Norway, that many of us are inclined to admire, for not getting a high enough score on a particular measure decided by the OECD. Or to treat the aim for schools (and universities) as if it were an Olympic event and your aim was to make a particular place in the final (for Australia, 'top 5').
>
> (Yates 2013, 39, 43)

Universities and Managerial Performance Assessment

The academics we interviewed took particular issue with what they viewed as an ever more pervasive shift toward a managerial style of performance measurement and accountability at Australian universities. The specific concern was that this has increasingly marginalised the domain-specific expertise and judgements of professional knowledge workers within their institutions, though without yet having dispensed with these totally. Managerial performance measurement favours the use of generic metrics for the assessment of teaching and research activities, with these taking a common form within an institution rather than allowing adequately for disciplinary differences. For example, research performance is measured by research income, or by numbers of publications, or by 'impact' factors of journals, despite the very different norms and contexts of, say, history compared with engineering. This marginalisation of professional judgements and norms was widely seen as problematic. One recurrent criticism was that formal assessments of research performances were using somewhat arbitrarily selected measures—the number of publications or citations for example—to evaluate the entirety of the research process in various fields, without any additional reflection on the limitations and usefulness of the performance data. The perception was widespread that current modes of assessing performances with their focus on a few metrics were inviting a range of gaming responses that are distorting the knowledge building enterprise (see Woelert 2015; Woelert and Yates 2015).

There was also widespread comment that current modes of assessing and managing the work of academics were having streamlining effects on knowledge work and stifling more creative and innovative approaches to both research and teaching (see also Gläser and Laudel 2007). This was viewed as inherently contradictory given that both governments and universities have been paying a lot of lip-service to innovation over recent times. In the research space, the focus on countable outputs such as published journal articles and predictable research outcomes was seen as creating a disincentive for pursing more long-term and more risky yet also potentially more rewarding research agendas. Similar effects were noted with regard to university teaching including doctoral education. Here, current institutional settings—the focus on timely completions of doctoral studies for example—were seen as favouring the mainstream rather than encouraging substantially new approaches and directions, even though the practical benefits of this focus were widely acknowledged. Finally, historians observed that the focus on output units in the assessment of research performances created a disincentive to producing time-consuming high quality, high density publications.

Administrative Overload and the Trust Dilemma at Universities

Another point of concern for academics was that the proliferation of performance-based accountabilities increasingly came at the expense of the focus, time and energy they could dedicate to their substantial knowledge work. They reported that the host of performance-related reporting and accountability requirements have created an administrative overload that significantly diminishes the time available to deliver in the core domains of teaching and research. For school teachers the concern was raised less frequently, and most often in the context of what they might need to do to comply with the complex matrix being developed for the Australian Curriculum template. But generally there was a sentiment that the knowledge work of teachers and academics had become more micro-managed and regulated than in previous times, and that this may have detrimental consequences on the quality and substance of such work.

With regard to universities, this increase in administrative overload can be linked to the proliferation of a host of formal and technically complex rules and regulations and compliance requirements prescribing the ways in which the performance data of universities must be collated, reported to and audited by governmental authorities. In the research space, for example, the ERA research assessment incorporates a range of idiosyncratic reporting requirements and a particularly pervasive and intrusive quality that goes beyond other national forms of research assessment (see Woelert and Yates 2015). And in the teaching space, the more recent attention to new quality assurance mechanisms has created a range of additional compliance requirements for all Australian universities, as well as a considerable standardisation of quality criteria and mechanisms of assessment. All this means that universities need to have centralised and complex performance data management and reporting systems in place, something which imposes a significant administrative and cost burden on these universities, and ultimately also on the academics working in them.

Our previous discussions suggest that in the governance of Australian universities a certain impasse may have been reached, and that this impasse is also felt on the ground by the academics working in these institutions. If current measures used for monitoring performances use up valuable time and resources that could be more effectively utilised elsewhere, if they implicitly reinforce a culture of risk aversion both at the institutional and the individual level, and if they bring with them considerable incentives to game these criteria, then the question must be asked how to move beyond them.

In many ways this brings us back to the issue of trust touched upon earlier (Chap. 4). The prevailing emphasis at the national system-level, on top-down forms of performance governance and accountability, signals little trust among government in the capacity of universities to do their work efficiently and effectively. Within Australian universities, a similar dynamic exists. Here, the measures of accountability that are imposed by various layers of management assume that

without these academics will not do their best in relation to teaching or research. Yet, the question needs to be asked whether the activities of both universities and of the academics working in them, in all their complexity, diversity and also unpredictability, can be effectively steered in current ways, prioritising top-down forms of accountability and the associated 'one-size-fits-all' performance measurement and management mechanisms. Perhaps, and as argued in more detail elsewhere (Woelert and Yates 2015), both within the relevant government authorities and within university management, simply too much trust has been invested in these top-down steering mechanisms and their purported efficacy. In any case, our discussions suggest that the opportunity costs of the various forms of performance and accountability measures now being used need considerably more attention than they have received to date.

Based on our previous discussions, we propose that there is a need in Australia to intelligently relax some of the current accountability requirements for universities and academics, and to make a serious attempt to push the current performance measurement and management system down the escalation curve (see Pollitt 2013). Do we really need annual reviews of research and teaching performances for all individual academics, given that in some parts of private industry such practice is regarded as increasingly outdated? And do we really need a detailed governmental assessment of research excellence at every Australian university conducted every two to three years, in addition to the professional assessments of research publications and grant proposals taking place on an annual basis, and given the complexities and significant overheads involved? Other countries—and this includes not only big players like the USA but also small countries such as Switzerland for example—seem to be able to foster and maintain a high quality research culture and significant innovation capacity without such comprehensive research assessment in place. Or, as is the case in the Netherlands for example, other countries have mechanisms in place that allow for more constructive and consultative forms of assessment, that take seriously the specific character and local conditions of those units which are evaluated.

To clarify, we do not mean to deny here the necessity for some defensible, non-arbitrary criteria for allocating research funds and making academic appointments, and we are also not advocating a return to the days (if they existed) where no accountability was enforced, and where academics were more or less left to their own devices. We also do not deny the potential associated with the ever more sophisticated ways of harnessing data for institutional decision-making and strategy. But we would argue that the present period has seen a one-sided and largely unchecked expansion of performance assessment mechanisms and associated forms of accountability that is not only producing ever more costs but also effects on knowledge work which appear increasingly counterproductive.

Centralisation and Bureaucratisation: Universities

In many ways, the preference for managerial forms of performance assessment as well as the administrative overload and trust dilemmas in Australian universities are expressions of a political tendency to adhere to highly centralised forms of steering both at the system and institutional levels, despite all policy rhetoric to the contrary. At the system level, the pervasiveness of one-size-fits-all quantitative performance indicators means that a highly centralised form of governmental steering control of universities can be maintained despite an apparent reduction in direct regulation of universities' internal affairs. This is particularly so since in Australia, the central authorities—that is, federal government—continue to set the 'rules of the game' (Marginson 1997, 65) by determining the relevant performance criteria and standards against which all universities are evaluated and, ultimately, funded. Telling in this instance is the relative weakness of system-level funding mechanisms in Australia that endeavour to harness and reflect differences in institutional profiles and missions. In Australia, the 'power of the purse' thus strongly compels universities to move in a similar, predictable direction, despite a pervasive policy rhetoric emphasising organisational diversity and innovation. Also noteworthy is the continuing absence of a proper intermediary body or agency in Australia that concentrates relevant policy expertise to allow government to more effectively liaise with universities and to make more nuanced policy recommendations and funding decisions (see Meek 2002). A body of this type existed in Australia up until the late 1980s in the form of the Commonwealth Tertiary Education Commission (CTEC), but was ultimately disbanded to facilitate a more direct ministerial control of the university sector, one which is more subject to short-term political interests.

Within universities a similar logic of centralisation prevails. Many of the academics we interviewed identified this tendency, not only in the preference for common, university-wide generic measures but also in the ever more expansive central regulation of performance assessment and reporting procedures. There was a perception that this trend produced cumbersome administrative processes, and was ultimately also detrimental to individual and organisational learning and development. For example, it was noted that the prescriptive design of teaching evaluations meant that these evaluations became less useful as a tool to learn more about and improve teaching at an individual or department level. Similarly, a widespread concern was that the continuing shift toward more centralised and regulated forms of performance-based control of academic work had come at the expanse of effective bottom-up flows of information and proper consultation within universities. As a result, the centre (including various managerial strata) was often seen to be out of touch with the actual conditions and complexities of academic knowledge work on the ground, and decision-making to be based on crude or unrealistic premises.

All this suggests that there exists a certain imbalance in the ways Australian universities are regulated and governed. Given the size and complexity of universities as organisations, there is a need for some form of central coordination and strategy at the university level. The same can be said with regard to governmental oversight of the university sector. And yet, the impression remains that both at the system and institutional levels, the pendulum has swung too far toward a rather inflexible form of centralised form of command and control that uses as its vehicle the various performance measurement and management mechanisms and the associated penalties and incentives. Why the almost exclusive reliance on 'one-size-fits-all' research funding mechanisms and quality criteria in Australia given the purported political desire to maintain and foster institutional diversity and innovation? And is there really a need, at the level of individual universities, to centrally prescribe exactly how evaluations of teaching or research are conducted across all faculties and departments? In the end, what may be needed on the part of government and universities alike is some 'letting go' to instil a renewed sense of self-initiative and participation into Australian universities and the academics working in them. One step in this regard could be a de-escalation of institutional forms of performance management aimed at controlling the work of individual academics. This said, the likelihood and success of such changes at the university level ultimately hinges on accompanying changes being made to the system-level funding of Australian universities, and the prospect for such changes appear dim at the present time.

Centralisation and Bureaucratisation: Schools

In the case of the school curriculum, as we saw in Chap. 5, a new national body, ACARA, has been created in Australia, with curriculum, assessment and reporting functions. But in this case, in contrast to universities, though it has current and potential future effects on the teaching and learning activities of schools, it is not adequate to discuss that impact simply in terms of an increased degree of regulation or centralised or top down authority.

For one thing, although this may be a significant move in terms of the politics of federalism in Australia, similar regulation and centralisation has previously existed but emanating from state level governments and institutions (and with considerable variation in different states, see Yates et al. 2011). The move to new forms of 'ministerialised' governance and establishment of new institutions (Boards of Studies), appointed by Ministers rather than public service based 'education departments', has been in train since the 1980s. However for Australian schooling a much-noted paradoxical issue is that since the 1970s the 'independent' and Catholic sectors of schooling have been receiving a very large portion of their funding from government sources, yet have been largely free from the kinds of regulation and accountability that the state sector answers to. So one aspect of the setting up of ACARA under the Labor government was a deliberate move, in the

light of seeing schools as part of a 'knowledge economy', to set up mechanisms that would draw all schools into some commonalities of substance (in terms of the curriculum) and minimum standards, at least to a minor degree.

So one interpretation of what has been happening in Australia is that some small steps are being taken to define minimum agendas of what all schools should be expected to teach, including the limits of what any school may avoid teaching (for example in relation to women's rights or the Australian legal system). Mandating some inclusion for all of science and history content is part of this agenda, and a very defensible element of the changes. Similarly, in relation to schooling and equity considerations, the decision to include all schools, including private schools, in the data display and comparison on the *My School* website, to make more visible the relative resources and relative achievements of rich schools, is an effort (heavily contested) to bring the advantaged more in line with the mainstream, to provide some accountability alongside the generous public funding they receive.

But the new authorities and mechanisms also bring with them new forms and scope of regulation. In terms of form, for example, the *My School* website presents data about schools that enables comparison of their results with 'like' schools. 'Like' is based on abstracted demographic measures, and sets comparative school test achievements and outcomes not just in competition with other neighbourhood or local independent schools, but on an abstracted national scale. In principle at least, it re-balances criteria for parental choice (or the market mechanism) from local reputation and appearance (do students wear good uniforms and behave well in public? does this school have a good curriculum?) to the test scores that they produce given their intake. This might be interpreted as a more objective comparative measure, but it depends on how well what is measured reflects what is important, a subject of much dispute, and it increases the extent to which the scores become even more the main lens through which the education activities of schools are understood. This, as we saw in earlier chapters, is a concern for history and physics teachers. Their concern is not about the existence of testing or measurement or standards discussions as such, but the extent to which these begin to override the activities of education in the classroom.

The ACARA governing body and its subsidiary committees is now dealing with a whole curriculum framework across the range of subjects, and it has to bring together different sectoral voices, and different state agreements, in order for the curriculum framework to be 'signed off'. This produces a particular imperative to create templates for the bureaucratic management of this exercise. Criteria and headings provide apparent 'transparency' and uniformity across subjects and levels of schooling, but are not equally suited to all subjects and levels of schooling. As well, when templates of this kind are developed, they create requirements to fill in content for each element of the matrix, and from the perspective of teachers a sense of an overloaded curriculum, even if the underlying substance was not intended as such by the subject committee or in the letter of the framework itself.

Conclusion

In this chapter we have returned to our interview data and earlier discussions to consider some effects of the widely noted spread of mechanisms of formal accountability and regulation in education in Australia. We show some difference in form and effects to date in the two sectors of our research. For universities, the performance assessment mechanisms are increasingly embedded at the individual level, especially for research. The government has assumed more direct steering of research priorities and has added to its array of reporting mechanisms, whose criteria and modes are increasingly replicated within universities. For schools a new national authority, ACARA, has been established, bringing together both state and federal authorities, as well as representatives of different school sectors. This authority has been charged with developing a new national framework for curriculum in Australia, as well as over-seeing a national assessment program in the form of NAPLAN and a public reporting website which includes detailed access to the curriculum framework and detailed data on individual schools enabling market comparisons. Schooling effects of such performance assessment (testing) to date are less at the direct individual teacher performance level than at the school culture level. But at the individual level, the detailed form and common template of the new frameworks has some effect on what teachers perceive they are required to do within individual subjects.

We note in this chapter that in principle some of the trends we discuss here are inevitable or even positive. The growth, complexity and perceived importance of universities has made some greater scrutiny of government funding inevitable, and the changing regulatory environment as well as globally competitive strategic situation for universities has similarly entailed a greater centralised oversight within institutions. Nevertheless, this study suggests that in a number of respects, Australia has embraced such processes more fully, more uniformly (in terms of criteria of assessment), and more mechanically than other countries, with large costs and opportunity costs associated with that. We have suggested the balance has tipped too far in the regulatory and assessment direction.

For schools there were and are some good grounds both for renewed attention to the curriculum of the nation, and for greater attention to the way funding and accountability (and their relationship) take place across all sectors of schooling (public, independent, Catholic), given the large amount of taxpayer funding underpinning all sectors. Similarly, the issue of standards of what is being achieved for students in different kinds of school and in Australia compared with other countries is a legitimate question. But, as with universities, we have suggested the balance deserves further attention. NAPLAN and PISA results are widely used for purposes for which they are not appropriate measures, and they do affect what schools prioritise in their curriculum agendas. Similarly the template forms and bureaucracy associated with ACARA can overload the curriculum with regulatory and accountability (‘tick box’) demands rather than what the teachers we interviewed understood to be centrally important in physics and history as forms of knowledge, even when they were not intended to have this effect.

Overall the issues raised by this study are about the extent, the form, and the location of the oversight of teaching and research knowledge work. In terms of extent, the proliferation of reporting and micro-management is a trend that has continued to escalate and needs to be checked and reduced in the light of its costs (direct and indirect on workload). In terms of form, the Australian preference for simple, centralised and uniform criteria offers bureaucratic efficiency, but cuts across and distorts differences in different forms of knowledge, the focus of this book. In terms of location, both for universities and schools, one of the themes we hear is a need to take better account of what should be done (and not done) at government level, what is a legitimate (or, conversely, inappropriate) central or management responsibility of universities or schools, and what needs to be open to specific professional judgement via university departments and peer assessment. Again, the suggestion of those we interviewed is that the trends in Australia have tipped too far towards the managerial and non-local exercise of accountability.

References

Gläser, J., & Laudel, G. (2007). Evaluation without evaluators: The impact of funding formulae on Australian university research. In R. Whitley & J. Gläser (Eds.), *The changing governance of the sciences: The advent of research evaluation systems* (Vol. 384, pp. 127–151). Dordrecht: Springer.

Marginson, S. (1997). Steering from a distance: Power relations in Australian higher education. *Higher Education, 34*(1), 63–80.

Meek, V. L. (2002). Changing patterns in modes of co-ordination of higher education. In J. Enders & O. Fulton (Eds.), *Higher education in a globalising world: International trends and mutual observations* (pp. 53–71). Dordrecht: Springer.

Pollitt, C. (2013). The logics of performance management. *Evaluation, 19*(4), 346–363.

Power, M. (1997). *The audit society: Rituals of verification*. Oxford: Oxford University Press.

Woelert, P. (2015). The "logic of escalation" in performance measurement: An analysis of the dynamics of a research evaluation system. *Policy and Society, 34*(1), 75–85.

Woelert, P., & Yates, L. (2015). Too little and too much trust: Performance measurement in Australian higher education. *Critical Studies in Education, 56*(2), 175–189.

Yates, L. (2013). Revisiting curriculum, the numbers game and the inequality problem. *Journal of Curriculum Studies, 45*(1), 39–51.

Yates, L., Collins, C., & O'Connor, K. (Eds.). (2011). *Australia's curriculum dilemmas: State cultures and the big issues.* Carlton, VIC: Melbourne University Press.

Chapter 13
Genericism and Specialisation: An Ongoing Problematic for Schools and Universities

A starting point for this book was that policies and public thinking about knowledge and about the purposes of schools and universities were in a state of change. Pervasive references to a 'knowledge explosion', the 'knowledge society', new information technologies, rapid social change, new forms of global communication and relationships were widely perceived as throwing into question what schools and universities had been doing in the 20th century. In this chapter we want to return to these debates about knowledge and the purposes of schools and universities, and in particular to questions about what role and purpose do disciplinary fields such as physics and history have in this changing environment. One line of argument we return to in this chapter is about the value for education purposes of specialised knowledge of the kind represented by these two disciplines compared with more generic approaches to knowledge (for example via competencies, capabilities, generic skills and the like). A second, and related line of argument concerns what kind of special role is justifiable or appropriate for schools and universities.

The arguments about both disciplinary knowledge and purposes of schools and universities are wide ranging. We are aware that the research project that has generated this book was not designed to investigate a full range of issues regarding the potential or qualities or limitations of new knowledge forms, nor the question of what belongs overall in the school curriculum, but rather the place of two traditional disciplinary fields within these. Nevertheless, we do think this is a time when we need to be careful to not gloss over questions of disciplinarity, specialised knowledge, and the conditions necessary for these to make a specific kind of contribution to education and research.

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Specialisation and Genericism: A Current Argument

We begin by outlining some recent arguments regarding specialisation and genericism in knowledge work in the curriculum (Muller 2015, but drawing also on Muller and Young 2014; Muller 2009; Winch 2010). This summary draws together some arguments about knowledge and the curriculum and the trajectory of contemporary changes we discussed earlier in Chaps. 2 and 3 of this book, and we return to it here as a starting point for reflecting again on the arguments and the findings of our research. The argument, drawing particularly on Muller (2015), is this.

(1) Not all fields of knowledge have the same purpose: some are more vocationally oriented, or concerned with building professional knowledge, and some are in principle 'truth-seeking' disciplines such as history and physics ('singulars' in Bernstein's (1996) terms). *All* of these fields draw on some mix of conceptual knowledge and know-how of various kinds (meaning not just skills but including the substantive knowledge and experience that underpins judgement and application in different fields), but they do it in different proportions. But true innovation depends on conceptual knowledge of the kind produced by the scientific or 'truth-seeking' disciplines (including, for this purpose, social science and humanities), because these are oriented to building a particular form of conceptual expertise that is inherently not tied to the specifics of the immediate or everyday. Engaging in (teaching, protecting, building) this specialist form of knowledge is the particular role of universities and schools, but it is now under threat.

(2) One reason this specialist form of knowledge is under threat is as a result of tendencies inherent in knowledge development. All disciplinary knowledge fields (and indeed occupational fields) over time develop greater specialisation and differentiation and this complexity becomes increasingly difficult to hold together for education purposes. School systems and universities have responded to the knowledge explosion by seeking to develop more generic forms to guide curriculum and assessment. (And the move in this direction has been hastened by other simultaneous developments in these institutions over recent times, in particular the greater focus on the learners rather than the curriculum, and on demonstrable outcomes). In universities and qualifications frameworks these generic criteria make few references to the substantive knowledge itself but focus on characteristics that can be applied in common across different knowledge fields, and tie different fields within a common template. They also tend to work by focusing much more on the learner and what they can do.

(3) This move to genericism inadequately recognises that the conceptual building and ability to innovate and go further is not content free. It may look like simply a process skill that can be taught ('problem-solving', 'flexibility'), but without the underpinning substantive work of disciplinary knowledge alongside them, process skills are likely to lose strength, and to stay in the circles of the everyday:

> We do not deny that the innovation economy requires innovative practical knowledge to be able to keep innovating. Our argument is simply that it also requires innovative conceptual knowledge to keep on innovating, and that the repositories and safeguarders of this capacity are the disciplinary singulars that are currently taking a bashing in popular media and academic quarters alike.
>
> (Muller and Young 2014, 138)

(4) In part, the move to disregard specialist and not immediately useful knowledge stems from the capture of knowledge production by market mechanisms. Here Muller and Young (2014) cite Thorsten Nybom's argument that whereas the earlier social contract between science (or the university) and society, was that it was the whole scientific endeavour (or specialist knowledge within universities) that was considered to be relevant and useful, now there is a 'perversion' where '"relevance" and "usefulness" gradually became synonymous with the ability to fulfil the more or less immediate and often short-term needs and demands of different societal "stakeholders", purchasers, or principal funders' (Nybom 2013, 27). In relation to schooling, Moore and Young (2001) have similarly criticised instrumental approaches which seek to define schooling solely in relation to workplace needs, arguing that such instrumentalism fails to address the conditions required for the production and acquisition of knowledge.

(5) The attempt to manage schools and universities through the more generic forms (capabilities, outcomes) unwittingly cuts across the conditions required for specialist knowledge production. Even though, Muller and Young (2014) acknowledge, most research and development managers understand the need for basic science as well as applied research, and even though education policies and qualifications frameworks and assessment schemes pay some lip service to this, in practice the conditions for such work are not well reflected in the policy and management frame:

> The 'skills talk' that most worries us is that form of discourse which pays lip service to the importance of knowledge but then goes on to concentrate almost entirely on the 'know how' requirements of the curriculum [and] obscures the curriculum requirements of the conceptual knowledge – its requirements for sequence, pace, progression and level of difficulty.
>
> (Muller and Young 2014, 137)

(6) In addition the conditions of conceptual knowledge work are potentially under threat from the emphasis on outcomes and outputs in both teaching and research: innovative conceptual work is necessarily risky, and working backwards from specified outputs or templates threatens this.

The claims being made in these arguments include theoretical points (that only specialised knowledge of a 'truth-seeking' type can give rise to 'true innovation'), empirical observations (that the special role of schools and universities as places for developing knowledge is no longer assumed or protected in

ways that it seemed to be in the past), and claims about cause/effect relationships, including predictions for the future (that the vocational, economic and instrumental pressures on universities are creating conditions that unwittingly undermine the conditions of specialist knowledge). Our argument on the basis of the research described in this book would be that some of these arguments are over-stated or not proven, but that the overall concern they identify about the conditions for the traditional disciplines is relevant and under-recognised in the rhetoric and many of the practices that frame the management of curriculum and research today.

More specifically, the claim that *only* disciplinary knowledge can give rise to 'true innovation' or knowledge creation we think is not proven either by Muller and Young's case or by kind of the project we undertook here. That is a question for other kinds of research, and plenty of that is in train in relation to the so-called 'new production of knowledge', as well as in work on big data, new materiality, interdisciplinarity and new communications and their potential for bringing together different kinds of research traditions. Where we and the history and physics teachers and researchers we interviewed do agree with the multi-phased argument above, is that skills talk (and associated organisational and assessment practices) often assume such skills can be taught directly and abstracted from substantive education traditions associated with such skills.

The claims in the Muller and Young argument above about the changing assumptions concerning purposes of schools and universities are true but overstated. Schools and universities, especially in Australia, have always had vocational agendas. Schools have always had important person/citizen forming agendas that are not well captured by seeing schools only as special places for building knowledge, and these are well seen in the current period in the concerns about history that we discussed in earlier chapters. Moreover, in both schools and universities, the tendencies with regard to genericism and the acknowledgement and support of specialisation have been more mixed than the arguments above might suggest. The attempt to develop a new curriculum framework via ACARA for example was in principle a more serious attempt to review and develop conditions for schools as knowledge institutions than a number of the state policies it replaced. But the process of doing this also produced some confounding tendencies. In universities there is a clear imperative to be more output oriented and to make disciplinary forms less central, yet the global rankings game, the national research assessment and funding mechanisms, also provide some pressure in the opposite direction.

In the remainder of this chapter we revisit our study to discuss in some more detail the directions at work and the issues we and our interviewees see in relation to genericism, specialisation and conditions of knowledge work in schools and universities. As is apparent from earlier chapters, the arguments about specialisation and genericism have resonance for both schools and universities, though the purposes and constraints of the two sectors are not identical.

Mixed Pressures and Mixed Purposes for Schools and Universities

In the case of universities in Australia it is not quite the case that market forces dominate everything. As previously discussed in Chap. 4, universities are still heavily regulated by government, and arguably in some respects more so than in former times. They also still receive considerable funding from the federal government, though that income source now is no longer the bulk of their funding (Marginson 2011; Norton and Cherastidtham 2014). Universities have to balance the need to attract undergraduate students to their programs of study, and to make decisions about the structure and financial attractiveness of how they divide up and package undergraduate programs and qualifications, and the priority they give to this compared with graduate level coursework programs, and doctoral research training. They are expected to meet business and professional demands for 'employable' graduates as well as educate students within specialist fields of knowledge. They have to seek sources of income via marketing to international students, and via collaboration with industry, as well as through success in competitive publicly funded research funding schemes, national and international. As a consequence, both for marketing (reputational) and income purposes, all of the Australian universities attempt, though in different ways, to combine some outward-facing promotion to the community and industry attesting their relevance and concrete usefulness, with some evidence of 'excellence' as measured by success in international and national rankings, citations, competitive grant performance and the like. In the research excellence assessments and league tables, traditional peer review judgements, and, arguably, traditional discipline-based norms, still play an important role, though there is growing interest in social and economic impact, and growing direction of funding to collaborative projects with industry or public bodies. So, arguably, it is in university interests to keep disciplines and conditions for 'discovery' strong, but alongside competing agendas to demonstrate usefulness and to meet policy-determined outcome measures in both research and teaching.

The physicists and historians we interviewed were conscious of some changes in the direction of a more generic or externally defined output focus, and we have discussed in Chap. 11 how they see these changes impacting on research. In teaching, the interviewees were aware of a new need to demonstrate that their teaching produced certain generic outcomes, general capabilities or graduate attributes—that is, non-discipline-specific and explicitly employability-oriented skills such as communication skills and problem solving. But in general those we interviewed tended to see these requirements mainly in terms of adding some new paperwork or need to communicate differently some purposes of their teaching and assessment in physics and history, rather than as having a significant impact on how they themselves approached their disciplinary field. That is, they saw disciplinary learning in these fields as underpinning deep forms of the desired attributes rather than in competition with these, but acknowledged some need to now sell what they did

in terms of such purposes. A number of historians commented that they now make more explicit to students the applied value in workplace contexts of the activities they are doing in terms of writing well and building an argument on evidence. Physicists tended to see the new requirements as an irritation, but similarly as not impacting in any major way on what they were trying to impart. They talked of physics students who had gone on to successful careers in fields like stockbroking and consultancy as examples of how the skills inherent in studying the discipline are transferable into other areas. At the doctoral level, in the two disciplines which were the focus of this study, there was little comment made about the need for a different kind of more industry-focused doctoral study, one that has more direct elements of a mode 2 perspective (cf. Cutherbert and Molla 2014). For their own fields at least, these academics, largely replicating the perspective of Muller and Young, saw specialisation not as in opposition to generic capability but as a source of it.

The academics however were concerned where they saw the conditions and standards for teaching being driven increasingly by managers or generic teaching and learning specialists who find generic rhetoric attractive but have little feel for the conditions of specialised knowledge or experience on the ground. This was neatly expressed in the submission made by Marilyn Lake on behalf of the Australian Historical Association (AHA) to a Tertiary Education Quality and Standards Agency (TEQSA) Discussion Paper on a proposal to establish standards for learning and teaching in Australian universities:

> The AHA is of the view that the proposed Standards Panel should not be dominated by senior university executives with little or no engagement with the scholarship of teaching and learning in specific disciplines. If this happens TEQSA will replicate the major difficulties that the British system confronted in the wake of the Dearing Report of 1997. The AHA believes that the Standards Panel should comprise persons recognized as authorities in particular disciplines.
>
> This Discussion Paper is focused on accountability and comparability, rather than on the aim of enhancement and extension of good practice. The AHA would like to think that [the] process envisaged would adopt a more creative approach to its work than implied in the observation that it will "accommodate innovation" (p. 5).
>
> The Paper relies on outdated ideas about 'generic skills'. Critical thinking, for example, is not a 'generic skill'. Rather it is translated in different ways in different disciplinary contexts to particular questions. One does not critically think about nothing.
>
> (Lake 2011, 6)

The opposite concern is commonly expressed by teaching and learning units of universities, who see the need for external drivers of better practice. O'Connor (2014) in a study of Australian universities introducing new online learning programs found that these were being driven by senior authorities and by more generic teaching and learning departments and leaders in the universities, and that a prime purpose for their introduction was a belief at senior levels that there was a need to shake up teaching. Nevertheless, in contrast to widely held perceptions about university lecturers as poor teachers, our interviews showed how strongly

many of our participants thought about their teaching and were concerned with how to engage their students in the best way within the disciplinary frame.

Although those we interviewed did not see current skills or capabilities agendas in their current forms as significantly interfering with their approach to teaching, they did have some concern that the heavy emphasis on employability is a factor that potentially discourages students from choosing these non-applied programs of disciplinary study. The employability agenda is seen in university websites and marketing and government reports, but it is not just driven top down. As fees increase, students too have a greater employability sensitivity. In Australia universities have always had vocational missions and have been seen by potential students and their parents as giving access to occupations with higher status and pay (in contrast, for example, to the US tradition of a first liberal arts and sciences phase underpinned by strong disciplinary departments). But today we see some concern by those working in the two disciplines that there is such an increased emphasis on employability outcomes that it works against the legitimacy of a phase of knowledge-building ('truth-seeking') for its own sake, or of the special role of universities in relation to knowledge, and works against the kinds of riskiness and openness that Muller and Young argue for. In such a context it is particularly hard for history to argue for its own specialised needs compared with the more outcomes-driven demands of management.

For teachers too, as we discussed in Chap. 8, there was talk about the effects of an increasingly utilitarian perspective on what schools do, this time via the increased competitiveness that has infected schooling, particularly in the higher secondary years, and that makes the battle for demonstrated pay-off the main game for many students, parents and schools.

Another problem for the academics is the pressure for time and space in the undergraduate curriculum. The pressures here come both externally from funding constraints and the drive by universities to achieve economies of scale and also from the growing differentiation of knowledge. Physics and history faced somewhat different versions of these problems. For physics, a traditionally 'vertical' field of study, the expansion of physics, technology and science more generally poses some problems. Research in specialist streams of physics requires high level mathematics, pursued systematically. At the same time there is danger in turning too soon or too completely to a highly specialised stream of study. Some of the academics interviewed discussed how in their area of physics it is not possible for students to achieve the depth of understanding to even comprehend their own research topic until well into the PhD but once this stage is reached the research process then becomes a creative pursuit. For creative development at the research level, students need some sense of how different lines of specialisation fit, of what might be exciting problems, of where new directions are likely to emerge.

For history, the resource pressures on the humanities take a number of different institutional forms. Universities may require new interdisciplinary subjects that are essentially fashioned to suit generic purposes and that limit the scope and time that can be given to historical exploration. A number of universities have now included in their first year Arts degrees large general humanities and social science subjects

that have replaced the more specialised discipline based subjects. While such subjects fulfil the requirement of reaching a greater number of students, a number of the history academics within these universities expressed concern that students' understanding of history in later years was lacking as a result. The push to have fewer and larger subjects can undercut the detailed knowledge of a period or country that was possible when students were offered a wider number of subjects and able to take those more specifically related to their detailed strand of interest and foundation for later research.

So, in relation to Australian universities we would suggest that the current policies incorporate a mix of drivers, both in the direction of weakening disciplinary voices and the 'special role' of universities in nurturing non utilitarian knowledge, and in the direction of having some reliance on the strength of these for reputational and research rankings health. The issue is when the conditions for the latter become 'unwittingly' undermined by the prominence on the former. And the former in this case is not only the concern with actual or potential pay-off and economic benefits, but an over-emphasis on modes that can be generically implemented, that place the emphasis on the generic and take away from the specialised concerns of the discipline. One form the issue takes in universities now is how to name subjects, programs, degrees, organisational units. We mentioned earlier the disappearance or collapsing of departments named for their discipline (more so for history than for physics, and more prominent in newer universities than older ones) and this raises the question of what does constitute the progression from first to second to third year, whether it begins to be judged in some abstract generic form, or alternatively builds more bits of horizontal knowledge rather than depth of knowledge. Curriculum reforms in different institutions may look similar yet embed quite different principles of what is legitimate knowledge, what are the criteria of assessment (taking Bernstein's (1971) forms of analysis). They may be constructed to demonstrate disciplinary differences and bring these into contention with each other, or may make mode 2 kinds of principles central (vocational and social effects and collaborative process), or may have a strong and generic 'skills and attributes' conception as the key principles.

In this context the curriculum review and advertising campaign by the University of Melbourne in 2005-8 might be seen as an example that attempted to counter both the view of universities as tied centrally to the disciplines and organisational structures of the past, and also the narrowly vocational view of universities that pervades political discourse in this country. The advertising campaign theme, 'Dream Large', was linked to curriculum changes designed to produce greater breadth and interdisciplinarity and entailed a more restricted space for focused disciplinary study at the undergraduate level. The campaign theme was intended both to convey some of the excitement about building knowledge, new ideas, innovation—but also to link it to bigger outcomes and 'grand challenges' (and of course to cement the university's positioning as a leader in its competitive national and international scene), that is, to link exciting knowledge work to study that lies outside or across rather than within disciplines.

As Bernstein (1971) argued 'integrated codes' give authority to the 'integrating idea' or problem as the 'legitimate' knowledge that is learnt and assessed, while 'collection codes' (subjects organised by disciplinary boundaries) give authority to the discipline and the modes and knowledge it has authorised as legitimate, and each of these produces some different forms of development both of knowledge and of identity. In interviews for the project historians teaching in a global studies course in a technologically oriented university emphasised the importance of their own historical training in how they approach their teaching and what they look for in the hiring of new staff, yet suggested that students that had undertaken the degree are less likely to see that emphasis or pick up on the subtleties of what makes an historical account different to political science for example. A similar point was made by physicists regarding their nanotechnology program. These issues might be seen as simple nostalgia or self-interest—that academics tend to want to replicate what they themselves have experienced. But there are also real issues about what is being learnt by students, and particularly what foundations they are gaining that enable them to themselves abstract and build beyond the subject they are currently studying.

In relation to school curriculum, as discussed in Chap. 5, the new Australian Curriculum was developed with a three-dimensional structure which sought to emphasise a form of disciplinary knowledge through the subject frameworks alongside 'general capabilities' and 'cross curriculum priorities'. Like the University of Melbourne curriculum redesign, the Australian Curriculum sought to engage with questions around who the students were expected to become over the years of schooling, with capabilities not just framed around employability skills but also personal and social responsibilities. However the Australian Curriculum framework also quite specifically reaffirmed the importance of disciplinary or specialised knowledge and ways of knowing in the school curriculum in the face of arguments that these structures are losing relevance.

As with the academics, the history and physics teachers were confident that their specialist subjects were a source of general skills. As seen in Chaps. 6 and 7, teachers acknowledged the importance of communicating the relevance of the subjects to students but did not tend to speak of skills in a generic form and rather discussed the kinds of understanding that students would take from the particular area of study (for example from physics understanding motion and how this leads to a better understanding of the realities of driving a car, or from history understanding how to evaluate claims on the internet compared with a generalised sense of 'critical thinking'). However while a commitment to a range of traditional school subjects as important foundations for young people was evident, a number of the concerns about what might be called 'unwitting undermining' or drift towards the generic were also raised, for example the setting up of the Australian Curriculum in terms of a standard template for all subject areas.

Because schooling is compulsory, an important mechanism of selection and opportunity, and a state-required induction in the way universities are not, some mechanisms to ensure fairness in high stakes assessment across different subjects or to make decisions about the scope, substance and length of compulsory studies

are common. The move in Australia to produce such decisions at a national level increased the bureaucratic forms through which multiple stakeholders and potential political opponents needed to work to produce consensus, both of organisational structures and in terms of template frameworks. The issue here in relation to arguments about generic and specialist knowledge is not just or primarily about what ACARA called the 'general capabilities', but much more about the form and implications of the compulsory framework overall.

One of the most significant concerns expressed by teachers was about time and the squeezing out of the specialist needs of the discipline. Many of the teachers we spoke to criticised the new curriculum in relation to the time allocated to them to get the subject materials across, and for history in particular, the amount of content embedded in the template-based framework. From the perspective of the teachers we interviewed, to mandate a discipline-based subject but with too little time or content overload turns it into another kind of study altogether, one that is more about memorisation and short-term test skills. The structure of the curriculum is one problem here—teachers reported challenges in drawing in the matrix of elements apparently required in each subject and feeling hamstrung by the predetermined and common template for the curriculum that ran across all subject areas. The Review of the Australian Curriculum (Donnelly and Wiltshire 2014) argued that the general capabilities should instead be integrated within the subject based curriculum to avoid confusion around where they are appropriate to teach, and that approach has since been adopted. The common template approach of curriculum development is another problem—a curriculum which honours the needs of the history discipline has different requirements in form than science/physics and vice versa, including in relation to how mandatory and optional content is presented.

Conclusion

We began this chapter with a somewhat lengthy summary of one set of arguments about 'genericism' and 'specialised' knowledge because when we attempted to begin with a nice clear definition of what we mean by these two terms they began to dissolve under our scrutiny. And there are a number of reasons for that. Like the array of arguments Hessels and van Lente (2008) identified as overlapping but not being identical to the 'mode 1' and 'mode 2' distinction in the 'new production of knowledge' (see discussion in Chap. 2), a number of different elements of the 'genericism'/'specialised knowledge' discussion are also overlapping and bring in different lines of thinking.

As with the mode 1/mode 2 arguments one concern here is about the changing framing of knowledge activities in universities and schools, and by framing here we mean both the specific regulatory or incentive mechanisms that are set up, and the broader cultural discourse in which these are embedded. The new production of knowledge arguments were specifically about re-framing of research. The genericism/specialised knowledge concerns are more specifically about

curriculum, and what is seen as a loss of a special 'knowledge-focused' role of schools and universities as compared with a myriad of other purposes. The questions here are about how far the framing conditions of schools and universities are changing in relation to curriculum purposes (to outcomes or utilitarian short-term pay-off rather than educational and longer-term substance). What our findings suggest, both for schools and universities, is that while some new generic agendas have been added, these have not (yet) undermined the commitment of teachers to the value and specific form of the disciplinary subjects they teach as a foundation. However, teachers do see the beginnings of an incursion via curriculum reforms and templates and a broader utilitarian impatience with non-applied knowledge which can produce some weakening of the conceptual specialisation and some impact on student subject choice.

A second concern is about courses, programs, subjects in the curriculum, and the way in which 'generic' as compared with 'specialist' forms are being prioritised, held together, or set in opposition to each other in different curriculum arrangements. What is happening here is more publicly visible in relation to the school curriculum than in the university reforms. For the school curriculum, when a framework is developed, the role of subjects compared with generic skills, the principles of progression and the like are all made explicit, at least at the level of policy aspiration. (As we saw from our interviews, the training or knowledge and identity formation that teachers themselves bring to their work continues to be a significant mediating factor in relation to what students are actually given access to). In the case of the Australian Curriculum prior to its review in 2014 there was an intention to keep the focus of different subject areas reasonably distinct and specialised, while adding a call for cross-curriculum and more generic skills to be somehow embedded across these. The issue of what would be given priority in this mix (in terms of disciplinary underpinnings compared with more generic concerns) was not tightly determined by this framework, but rather by practices at the level of schools and by further regulation of the curriculum and its resources by state authorities, and it has since been further modified. (In the case of primary schools by a de-emphasis on the range of separate subjects compared with more integrated teaching; in the case of secondary schools by indicating that general capabilities should be conveyed within subject agendas, not in competition with those). But both teachers (that is, the history and physics teachers) and curriculum authorities here at least seemed to share some understanding both that the specialist disciplinary knowledge was an important foundation they wanted to convey in some sense to their students, and also that disciplines and knowledge are not static, and that capabilities and outcomes and the way a generation is to be formed are important agendas for schools.

In the case of universities, we heard more about some pragmatic concerns (time, move to fewer specialised subjects) than about how specialised and more generic interests were in play. Those we interviewed understand their disciplines as always in process, and that some balancing of specialist and generic knowledge is an ongoing issue within their disciplines as well as across the undergraduate programs more broadly. However the question of whether the principles of

progression in universities are becoming more generic, and with what effects, is well signalled by the arguments with which we began this chapter and, we suspect, not well addressed by the ways in which macro-curriculum reforms in universities commonly occur, top-down and by competition for students.

By embarking on a study which paid attention to both secondary schooling, undergraduate education, and research, our project assumed the need to consider what is set in train over time by forms of education. For example, if strong interdisciplinary research requires strong disciplinary identity as a starting point, a curriculum that moves heavily to generic, topic-based modes may weaken it. And if the students who later become teachers are formed with weaker disciplinary identities, this impacts on what the next generation learn at school, regardless of the curriculum framework on paper. (There may also be potential gains in the forms of knowledge students develop in new undergraduate curricula. They may be more cosmopolitan in outlook, more generalist, more attuned to new developments in the world). But the forms of what is set in place at one level of education do impact on the other.

So, in relation to the arguments about genericism/specialised knowledge, a third set of concerns is what different forms and emphases in these will produce as outcomes over time. Here Bernstein's (1971) work on integrated and collection codes discussed earlier in this chapter is particularly salient, in particular the danger that integrated codes may tie students to the integrating idea or problem of the day by which they are set up, rather than allowing a foundation to build from a discipline into new directions and problems. The genericism/specialised knowledge interests are of particular relevance to the project we have undertaken, because, more specifically than 'new production of knowledge' arguments, they are concerned with the implications of what is produced over the education life cycle and beyond it: what foundations for individuals in their life beyond the immediate end-of-year examination, what kinds of discovery or innovation longer term.

Our project focused on two disciplines or subjects, history and physics. But the discussion in this chapter raises questions about what is involved in the broader curriculum reforms underway in universities and schools. For universities what knowledge-building principles are at work when new subjects are developed? If either the generic skill or the theme or integrating idea dominates disciplinary judgement is this an 'emptying out' of these subjects, subordinating them to the dominating idea, substituting forms of relevance, but without the disciplined conceptual underpinning that will allow new mysteries to be seen? Or are these signs of new knowledge (even disciplinary) forms in the process of creation?

References

Bernstein, B. (1971). On the classification and framing of educational knowledge. In M. F. D. Young (Ed.), *Knowledge and control: New directions for the sociology of education*. London: Collier Macmillan.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor and Francis.

Cutherbert, C., & Molla, T. (2014). PhD crisis discourse: A critical approach to the framing of the problem and some Australian 'solutions'. *Higher Education, 69*(1), 33–53.

Donnelly, K., & Wiltshire, K. (2014). Review of the Australian Curriculum final report. Canberra, ACT: Australian Government Department of Education. Retrieved from https://docs.education.gov.au/documents/review-australian-curriculum-final-report

Hessels, L. K., & Van Lente, H. (2008). Re-thinking new knowledge production: A literature review and a research agenda. *Research Policy, 37*(4), 740–760.

Lake, M. (2011). Submission to the TEQSA discussion paper, June 2011, 'Developing a framework for teaching and learning standards in Australian higher education and the role of TEQSA'. Australian Historical Association. Retrieved from http://www.theaha.org.au/wp-content/uploads/2015/06/TEQSA_Discussion_Paper-submission.pdf

Marginson, S. (2011). Global position and position-taking in higher education: The case of Australia. In S. Marginson, S. Kaur, & E. Sawir (Eds.), *Higher education in the Asia-Pacific* (pp. 375–392). Dordrecht, The Netherlands: Springer.

Moore, R., & Young, M. (2001). Knowledge and the curriculum in the sociology of education: Towards a reconceptualisation. *British Journal of Sociology of Education, 22*(4), 445–461.

Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.

Muller, J. (2015). The future of knowledge and skills in science and technology higher education. *Higher Education, 70*(3), 409–416.

Muller, J., & Young, M. (2014). Disciplines, skills and the university. *Higher Education, 67*(2), 127–140.

Norton, A., & Cherastidtham, I. (2014). Mapping Australian higher education, 2014–15. Melbourne, VIC: Grattan Institute. Retrieved from http://grattan.edu.au/wp-content/uploads/2014/10/816-mapping-higher-education-20142.pdf

Nybom, T. (2013). Power, knowledge, morals: Society in the age of hybrid research. In S. Rider, Y. Hasselberg, & A. Waluszewski (Eds.), *Transformations in research, higher education and the academic market: The breakdown of scientific thought* (pp. 21–37). Dordrecht: Springer.

O'Connor, K. (2014). MOOCs, institutional policy and change dynamics in higher education. *Higher Education, 68*(5), 623–635.

Winch, C. (2010). *Dimensions of expertise: A conceptual exploration of vocational knowledge*. London: Continuum.

Chapter 14
Knowledge, Disciplines, Identities and the Structuring of Education

A recent Israeli film, *Footnote* (2011), dramatised some generational change taking place in universities in the form of a story of a father and son who were both scholars in the same university department of Talmudic studies. The father, Eliezer, had laboured all his life on details of texts, using traditional methods of scholarship, and with his most revered achievement to the point where the film began being to have his work acknowledged in a footnote by the major expert in his field. The son, Uriel, was known for the free-flowing changes he had brought to his study in the field, moving outside the traditions of his discipline and freely drawing on anthropological and feminist perspectives. Unlike his father the son was charismatic, regularly on television, and very popular with his students. The film's narrative turns on a misunderstanding about the most prestigious award made each year by the national Academy of Sciences and Humanities. The father thought the award was finally being made to him as a lifetime recognition of his career and scholarship, when in fact the prize committee had intended the award for the son.

This film captures something of the changes in train in universities as knowledge institutions but at the same time tips the scales fairly heavily in the way it portrays two kinds of academics. In the film all the characteristics loaded onto the father seem designed to reinforce that stereotype that in everyday speech accrues to the adjective 'academic': dry, other-worldly, opposed to change, obsessed with things that do not matter and that are not useful. And the characteristics associated with the son seem designed to display the full array of qualities university reforms in Australia are looking for in contemporary academic workers: modern, interdisciplinary, a popular teacher, a good media presenter, doing research which can be readily communicated to the public, in tune with the agendas of the day. But the tipping of the scales in these stereotypes skates over some issues we have been trying to take a close-up look at in this book, in particular what is it about disciplinary study that matters, and how do Australian academics who have been trained in history and physics see their work and agendas today?

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The ‘at the crossroads’ issue that was most foregrounded in this study in relation to the conditions in which teachers and academics now work was about the impact of changed forms of management of their work. More specifically, issues were raised about the effect of curriculum decisions and performance measures when these were designed for and interpreted by management purposes from outside the field, particularly the use of generic rather than field-differentiated ways of measuring and seeing achievement. These management agendas and measures have acquired new salience in schools as well as universities, though not in identical forms. A second issue flagged in these chapters that is especially evident in the work on an Australian Curriculum and responses to it, but is also a major issue for universities today, is the substance of curriculum—which topics, subjects, kinds of study need to be included now. In both schools and universities what has changed is a sense of the need for an orientation to the future rather than passing on the wisdom of the present (Yates 2012). And a third issue, from the perspective of research and knowledge creation, is what the changing curriculum orientations of school and the undergraduate years will produce or constrain going forward as knowledge, innovation, capacity and conceptual advance.

Knowledge Forms and Drivers

One of the central tensions that runs through many of the chapters in this book is between inward focusing (that is, internal to the discipline) and outward focusing orientations—in knowledge building, in academic identity, in university management, in developing school curriculum. Some interpretations of mode 1/mode 2 thinking discussed in Chap. 2 set up a stark binary between the ‘new’ production of knowledge, characterised by strong outward-facing attention to the problems in the world and the inward facing or more self-contained forms of traditional disciplinary knowledge. Yet in fact neither mode is entirely confined to either ‘inward’ or ‘outward’ knowledge forms: the new production of knowledge still aims to incorporate specialist expertise; and disciplinary specialist knowledge over time has been responsive to changing social agendas. In this research we chose to focus on fields that are historically representative of the disciplinary knowledge work, but even here, to assume a simple binary choice between outward-facing and discipline-facing, or that ‘mode 2’ forms are entirely over riding the shape of knowledge work in universities, over-states the situation, and gives too little attention to where there is some real conflict and to what needs to be protected.

In terms of knowledge and the purposes of schools and universities, there have always been strong concerns in Australia with outward-facing purposes: employability and examination results in the case of schools; in universities, employment capabilities of graduates (at least in the case of professionally-oriented undergraduate studies, not necessarily for general degrees); and social and economic impact in the case of research spending. Indeed public comments from employers about the inadequacy of curriculum and schools more generally is one of the most

long-standing and recurring tropes of public discussion of these institutions; and similar themes have been common in comments about lack of 'work readiness' of university graduates (though some recent research suggests a more positive judgement by employers, see Oliver et al. 2014). None of this is new in the Australian context. What is new is some intensification and greater prioritisation of these purposes and the development of new mechanisms of managing them (see Chaps. 4, 5, 8, 11 and 12). What we found from our interviews was some concern about negative and unintended consequences of the new modes, but not a picture of academics and teachers simply clinging to the past.

The school teachers and historians and physicists we interviewed were very aware of the broader context in which they work and which pays their wage. For them commitment to their disciplinary field does not preclude justifying its relevance or utility in relation to the vocational skills it produces (not that all do this equally well, or that there is not at times some resistance to the prioritising of this). At an individual level many academics were involved in collaborations outside their discipline in teaching and in research, and were interested in some of the 'grand challenge' kinds of problems that are so prominent in university websites today. But almost without exception, both in universities and in schools, those we interviewed believed in the importance of developing some 'insiderness', some 'truth-seeking' orientation *to* the discipline as an important foundation for students who will live and work in today's world, and saw it as an important source of conceptual advance and innovation. In this they echo arguments made in the literature which we discussed in earlier chapters (see Chaps. 2, 3, 10 and 13).

As we saw in earlier chapters, the specifics of representing for education purposes what is now central to fields that are in the process of differentiating, further specialising and shifting boundaries is a challenge, and difficult to get detailed consensus on, both for schools and for universities. But across the quite different disciplinary fields we focused on in this study, and across participants who taught in them at different levels, there was some broad consensus. Learning history or physics involves not just knowing things but being formed in a certain way—learning to pick out some things as important, and to acquire a deep sense related to that of what matters. This does not mean that those formed this way remain static, or uninterested in the social or pedagogic implications of their work. Rather it is an important foundation they bring (and want their students to be able to bring) to new problems and new types of collaborations. It is different from what can be picked up either by internet google searching of information; or from a problem-based utilitarian approach, and was evident in the thinking of both physics and history teachers in relation to proposed school curriculum reforms. This insider orientation is both social (acquiring some collegial identification with others in the field) and epistemological (learning the focus, approved methods, approved forms of judgement that have been developed in that discipline). And, as we discussed in earlier chapters, it has both productive qualities (for example, Abbott 2001; Bernstein 1971, 1996; Muller 2009; Young 2008) and gate-keeping narrowing qualities (Bernstein 1971; Biglan 1973a, b; Becher 1989; Lamont 2009). The big questions for both schools and universities today are how much of this kind of disciplined

approach needs to be nurtured, and where and how different starting points or more generic or interdisciplinary structuring of curriculum are important.

Through a range of their concrete concerns about the structuring of schools and universities, our interviewees conveyed their understanding that disciplinary knowledge requires some developing of insiderness or disciplinary identity and orientation to the disciplinary field. For example schools teachers were concerned about who would teach the subjects, particularly the use of teachers who were themselves not trained in history or physics. (For different reasons this is not uncommon in these two fields in Australia. With physics the problem is the very small numbers of physics graduates who go into teaching. With history the problem is that it is often considered such a generalist subject that anyone can teach it from the textbook and thus available to be used that way to balance timetables and workloads within the school). The kinds of teacher-proof curriculum being developed by some private corporations in the USA and by at least one Australian state may work for the basics, but they embed a form of outcomes defined curriculum that does not have the deeper connection to developing disciplinary dispositions and judgements and this was an important part of the case as to why these forms of study are valuable, as discussed in Chaps. 2 and 13 (and see Muller 2015). Having too little time or an over-crowded curriculum has a similar effect. At both school and university, physicists were struggling with the problem of mathematics and increasing specialisation precisely because they understood that the conceptual orientations and the mathematical were so intertwined that the over-balancing to one or the other could have negative consequences on the foundational orientation of students. Historians, used to being left to structure their subjects to develop what was important by substantive and content-based examples and interactions, were struggling with the new templates and curriculum reforms coming from outside which emphasised the need for more generic and very explicit process criteria.

These concerns point to two issues for broad policy and management of curriculum in schools and universities. One is the importance of having some substantive teaching and disciplinary expertise, not just management or bureaucratic expertise, in the contexts where frameworks are being developed (see Fensham 2012; Lake 2011). The second is giving more attention to the role of and need for local flexibility and judgement compared with centralised criteria in the frameworks that are set up (see for example Gornitzka and Maassen 2014; Woelert and Millar 2013; Woelert and Yates 2015). The sense from this project is that Australia has been tending to tip too far in the direction of centralised micro-management.

In the film *Footnote*, and in Australian policy rhetoric, tight disciplinary orientation is often associated with narrowness and wanting to cling on to an older and comfortable world view rather than being open to the changing world and its challenges. Yet there is a sense in which disciplinarity has a breadth and an openness to change that is less narrow than the policy and reform environment we are now situated in. In Australia, as we discussed in Chap. 12, universities are regulated in many ways, and are narrowly accountable on an annual basis as well as three-yearly in the ERA research assessment. There is a constant imperative to show local economic or social benefits in the very short term, and to shape activities

to what is currently valued by the Australian funding schemes, schemes that are particularly consequential given the lack of alternative major funding that is often apparent in other parts of the world. Looking for 'pay-off' in a short cycle is not inherently more attuned to preparing students and researchers for the 21st century, nor less narrow, than orientation to a disciplinary field. 'The discipline' is inherently international in its communication, marked by ongoing change in its theories and agendas and has forms of peer judgement that take it outside local fashions and jealousies (though acknowledging that it too has its own limiting drivers).

Identities, Motivation and Knowledge

In this project we have tried to keep in view both the people (the knowledge workers) and the debates about knowledge in the curriculum and higher education literature. The focus on knowledge (or more specifically knowledge in the context of education institutions) requires us to keep in frame a longitudinal and prospective perspective: what has produced the attitudes we find here, what flows in the longer term from the practices and reforms we see in our study. This is different from ethnographic studies which bring to light the daily and material practices of scientists or teachers at a point in time. We were interested in the teachers and academics as agents of their disciplines, and what they bring to their knowledge work from their own formative experience in that discipline as well as their experiences in their institutional settings and disciplinary communities now. But to consider what is happening to knowledge, we need to see these as located in a dynamic that is temporal, extending beyond these perspectives at one point in time. What the school curriculum sets in train impacts on what is done in undergraduate studies, and those studies in turn impact on what is brought to research training and research agendas. And the influence is also in the opposite direction: via the teachers of tomorrow and the knowledge and identity they have formed from their own university studies today.

The academics in our study embody as well as report on the way in which the current context is now more pragmatically and competitively and vocationally driven. They are highly reflexive today about the institutional settings and conditions they work in. The pragmatics of what it now takes to maintain an academic career are explicitly entering the mind-set of Australian academics—which topics they take up; the importance of quantity of performance in publication and grants; the concern about the detrimental impact of time spent on teaching notwithstanding the formal policy commitment to improving teaching quality; the research assessment coding and implications for where they need to publish research; their need to sell the applied impact of what they do. This is a potentially significant change in academic identity, especially for those working in the older research intensive universities in Australia, and in some ways it is inevitable.

However there are dangers to motivation entailed in the increasing presence of extrinsic management-generated motivators in the forms of template measures

of performance review. In the past academics have been primarily drawn to their employment by high levels of intrinsic intellectual interest in their field. To accomplish their work they normally complete a long under-paid apprenticeship then work much longer hours than are recognised in formal funding agreements. They traditionally value highly their self-assessed substantive achievements as researchers and as teachers, and also external recognition by peers and sometimes public authorities of these achievements. Now ongoing extrinsic assessments of a different and managerial kind are a regular feature of university management and funding systems. These assessments are intended to drive efficiencies (expose unproductive workers), and to drive behaviours to corporate or national goals. But they risk undermining some intrinsic motivation if the external criteria seem to be at odds with what is respected within the field. In interviews we heard signs of this from historians being driven to reduce their time on teaching in the interest of increasing quantified research productivity and from physicists concerned that counting outputs (number of publications and even citation counts) could be a quite misleading measure of comparative achievement by different researchers. They were aware too that doctoral completion efficiency may be an admirable or necessary aim, but that it leads to a focus on more do-able rather than more challenging projects, and that national measures of research quality in the form of ERA do not always produce results that those in a particular field respect (for example where research from another field has been re-classified to inflate the rating of a particular discipline). Some Australian Nobel prize-winners have said publicly that they would not have been able to undertake the same research in the current conditions of short-term accountability and deliverables.

A further change here is the changing shape of academic employment. Over recent times the rhetoric of the knowledge economy and global pressures to compete have led to targets for more mass participation in higher education at the undergraduate level, and a marked increase in numbers encouraged to take doctoral study at the postgraduate level (Altbach et al. 2009). But at the same time a much higher proportion of academic employment in Australia is now casualised (May et al. 2011; Norton et al. 2013): teaching carried out by historians and physicists who are paid by the hour; researchers on short-term contracts and with few possibilities for promotion. For those at the top of the disciplinary hierarchies, especially in science, there is now a global market with plentiful material rewards. But for those on the lower rungs there appear to be more sticks than carrots, and easier opportunities for advancement outside the scholarly field itself (Bell and Yates 2015).

What kinds of academics, teachers and researchers are evolving today, and with what motivations, is an interesting issue. Lam (2010, 2011) rightly comments that some current critiques of universities portray academics as puppets whose actions and thinking are determined by whatever new policies and conditions are put in train, rather than seeing them as agents who respond actively, themselves deciding what is most important, and forging ways to operate as conditions change. (See Hood 2006; Verbeeten 2008; Weingart 2013 for a few examples of gaming practices and responses to new governance forms).

Lam's (2011) empirical research on scientists and commercialisation agendas suggests a range of different responses are currently at work. This work proposes that among scientists some are motivated more by the 'ribbon' (academic recognition), others by the 'puzzle' (the problem they are engaging with), others by the 'gold' (or extrinsic reward), and that these play out in different ways in response to the current university drives towards mode 2 kinds of activities. For scientists, she argues, intrinsic and reputational motivators can be more important in motivating scientists to collaborate with industry than direct extrinsic rewards or sanctions, and the policy of trying to drive commercialised activities primarily via the extrinsic motivators is not an optimum management strategy. In terms of identities and academic agency, Lam (2010) notes that those facing the more limited employment opportunities now available at the early career entry point may develop 'hybrid' identities to let them maximise opportunities to work across different kinds of academic and non-academic roles. Some sign of this is evident in Australia in the very marked growth of research management as a professional field in universities, employing many with doctorates or who began their career as researchers.

Our study was not set up as a study of motivation, but motivation issues can be seen via their traces in the implicit and explicit values academics and teachers showed when talking about disciplinary knowledge and the reform contexts in which they were situated. And, in contrast to Lam's studies, we were struck more by what was similar across these responses than by the differentiations among different academics, though these of course exist and would be more noticeable in a different type of study. Differences were somewhat evident in our study generationally—in the greater welcoming of some forms of accountability and regulation by younger academics who saw these as ways of improving teaching and calling to account those older academics who were less productive and occupying employment opportunities that are scarce relative to the numbers now graduating with doctorates. But overall, across quite a diversity of participants, we heard an acceptance of accountability, a concern about maintaining what they considered important in their disciplinary knowledge, an openness to collaboration and interdisciplinarity and some new agendas, but alongside some de-motivation and some dilemmas of how to balance components of their work given greater intrusion of management workload and the use of templates that assumed everyone should be producing similar patterns of performance and activity.

So in terms of the changing agendas for universities and university knowledge, the physicists and historians we interviewed tended to fit neither of the stereotypes with which we began this chapter. While many of them were working across previous disciplinary boundaries and were involved with the kind of engagement and public communication demonstrated by the son in the film *Footnote*, they also articulated why some of the characteristics of the father needed to be part of a disciplinary education. Learning the ropes with some care and attention to the ropes rather than the outcome they saw as important, as foundations for the more freewheeling activities, as did the schoolteachers coming from the same disciplines. They were frustrated with the use of generic templates (measurements, 'impact')

to measure performance, because they believed that these were being wielded crudely and distorting elements of disciplinary activity that were important.

Schools and Universities

Except from the perspective of school to university transition and demography and participation patterns, it is surprising how much schools and universities are normally kept separate as objects of research and indeed of policy attention. Yet in curriculum terms, not only do they face some of the same dilemmas (how to select what is included in curriculum or programs, what emphasis on generic skills and assessment compared with specialist knowledge) but they are, over time, somewhat interdependent,[1] at least in relation to the two fields we focus on in this study, history and physics. In the research on which this book was based we focused across the whole formal cycle of general education from secondary schooling, through undergraduate to postgraduate and research. And although we started this chapter by an anecdote more clearly relevant to universities, other issues, particularly curriculum ones, can be seen more visibly by beginning with a focus on schools, where the issues involved in curriculum are played out more visibly in public and in ways more differentiated from the concerns about efficiencies or marketing that often drive university reforms.

From a policy perspective, even where there are similar ideologies of management in schools and universities of the kind we have discussed earlier in this book (Chaps. 4, 5, 11, 12), differences of purpose and politics are also inevitably in play. For schooling, questions about what range of knowledge or what kind of induction of young people is to be compulsory, how far common curriculum is enforced across the country and across different school sectors, international comparative evidence about standards in key areas, and issues of choice and equity in relation to school provision (including curriculum) are all important. Higher education is more directly linked to concerns about national economic performance, and needs of particular professional and industry areas.

Yet the first and somewhat surprising thing we notice today in looking across school and university in the context of our research is how similar are some of the issues they face in relation to knowledge—not just the obvious issues about global change, new technology, what kind of work will be done in the 21st century, but also the other side of that, the questions we have been pursuing in this project. What kinds of knowledge or foundations (especially related to disciplines) should be retained in order to give some depth, conceptual power, ‘problem portable’

[1]We acknowledge that there is a longstanding debate, especially from the perspective of vocational education, of whether there is too great an interdependence of the so-called ‘academic’ agenda in schools and control of schooling agenda by universities (for example, Keating 2011), but that is beyond the scope of the current discussion.

capability development, to students for their future lives. This book has not tried to answer the difficult question about what overall scope of curriculum is relevant today, but it has tried to explore the case that these disciplines do have something important and distinctive to offer, and that this can be difficult to hold together in the face of approaches that emphasise immediate relevance and pay-off as the key agenda, or that move too far in the direction of a uniform template for course structure and assessment. Even the assessment of the PhD in many Australian universities is now being accompanied by a detailed but generic grid for examiners to tick or score alongside (and potentially beginning to supplant?) the examiner's engagement with the research 'contribution to knowledge' itself.

But school curriculum faces a particular scrutiny that is public and differentiated from the choices different universities make about the curriculum they offer in the post-compulsory period. History teachers thought history was important knowledge for students yet were worried about the consequences in Australia of making it mandatory across the compulsory years of schooling. In part this is because a central question for the school curriculum, *which* content of history should be taught (i.e. the selection of topics, periods, countries) is not something that can be answered as such by the discipline (though disciplinary voices should certainly be a contributor to that discussion). Whether Australian students should spend more time learning about Britain or Asia or about local or world history or ancient or recent history is an important curriculum question in relation to history in schools. But it is not itself a historical question but a normative decision about the substantive formation of young people in this country today. But historians and history teachers are also adamant that imposing such normative or political choices of topic and content without regard to the discipline of history (learning what is involved in producing history) undermines the whole enterprise—turns it into a transmission of official messages that are nearer to propaganda than history, and in any case are likely to be ineffective or even counter-productive. And this is where the constraints of the conditions of school come into play. Having a formal national curriculum on paper and held up to scrutiny for its 'messages' is one thing. Understanding what happens when too much is required to be taught in too little time, or with too little regard to the students and their interests, or when subjects other than history are what will be important in the competitive assessment game, all impacts on what if anything this achieves as knowledge.

History and Physics

In many ways the responses of those who work in history and physics in this study confirmed descriptions of the features of these fields as disciplines that have been noted in previous studies (see Chap. 3). Physicists reflected the convergent understanding of what is core to their discipline, and of its broadly vertical characteristics. Historians shared a strong sense of and loyalty to history alongside acceptance of paradigm differences within it and 'horizontal' building

of the discipline that are common in the humanities. Participants from both fields retained strong disciplinary identities regardless of their current location, and made similar arguments about the value of that disciplinary learning as a deeper form of skills and capability that would be valuable for students beyond school and university. Both had some concerns (both at school and university) about a growing utilitarian emphasis that was influencing student subject choice and orientation to their study. At university, they also shared some concerns about management templates for productivity, and about reforms and measures that prioritised interdisciplinarity rather than disciplinarity or the converse. Given the extent to which academic interests are so often posed as STEM versus HASS, the 'two cultures' of arts and science, this overlap of perspective from two 'enabling' (or 'pure') disciplines in each category is important to note.

However this study also found some ways in which 'two cultures' are positioned differently in the current wave of change. Even leaving aside direct funding decisions and incentives which we did not investigate in this project and which flow much more to the sciences than to the arts (for more science teachers, science undergraduates or for science research), history and physics are positioned differently in some of the reforms in train as a result of their knowledge cultures, their knowledge forms and their contributions as fields of knowledge. And this is an issue both for school curriculum, and for the historians and physicists who work in higher education.

In school, history and physics teachers had shared concerns about the need for their subject to be constructed in a way that engages students, and draws them into some sense of what those fields as disciplines are about (and not just as an issue of pedagogy or teaching strategy). However the problems they identified in doing this had somewhat different sources for the two fields, to some extent stemming from the extent to which science is clearly understood as specialised and hierarchical knowledge, and history, even as a strong discipline, has a public facing as well as a specialist academic conversation.

Physics in the junior secondary school is taught as part of general science, and in the senior secondary school as an optional subject chosen either by those who will go on to further study in physics, or by those aiming to maximise their ATAR (Australian Tertiary Admission Rank) score. Ideally, physics teachers (and academic physicists) wanted students to acquire a range of 'foundations' via the study of physics. They wanted students to gain a basic hands-on sense of experiments and how they worked, they wanted students to see the link between physics and mathematics, and to begin to develop these mathematical underpinnings, they wanted students to understand (and preferably gain respect for) the kinds of problems and knowledge physics had and was continuing to produce. But they also understood that emphasising or de-emphasising some things rather than others (mathematics, specific topics) drew different students into the field and produced different cohorts at university, particularly in relation to gender. Although physics has some agreed core and vertical characteristics, the issue of what works as foundations at school level is more complex than this might suggest. But essentially the problems of engagement and the construction of the physics subject are

worked out within field, by physics teachers and physicists rather than primarily by public or political fiat. (Though with some exception at times in relation to concerns about gender imbalance, and some push and pull as arguments about the numbers entering physics or engineering are debated, and trade-offs made about the mandating or not of pre-requisites in the final year of school). Physicists and physics teachers do not want to see physics become a 'social studies of science'—but they do want students to admire what physics has achieved and to have respect for its contributions across a range of areas important in the world today. Their engagement issue is mainly about how to balance different components of physics study, and to a lesser extent, about which topics are chosen in the senior years.

For history teachers the engagement problem is in considerable part about the choice of topics, the impact of making the subject a compulsory subject, and about the space needed to make the subject meaningful. Here the voices making claims on what is to be taught, and what matters as history, come as much from outside the specialist field of history as from inside it. In Australia at least, politicians and those in the public debates on both sides want history to be strong in schools as a way of teaching students who they are or how they are located in the world: the content is important. The teachers we interviewed also value history as engaging with a world out there and the past. But they know that it is impossible to teach all of history and want students to study topics that will engage them so they are drawn into the foundations of thinking about evidence, time, judgement, interpretation. Teachers we interviewed were happy to have a broad agreed framework for what students are to study, one that avoids repetition or glaring omissions, but their experience suggests that overloading content, and overloading Australian history, does not work.

In Australia the political debates ('history wars') about which stories of history should be emphasised are particularly strong and significantly tied to issues of national identity and citizenship. But our account of the discipline throughout this book (see Chaps. 3, 6, 9, 13) should make clear that this is not a side issue, or unimportant, or easily brushed aside, or, in a democracy, easily resolved. It is intrinsic to the contribution of history as a discipline (one not marked by 'paradigm consensus'), and it is important to the knowledge agenda for students in school.

In universities, both historians and physicists voiced objections to some new forms of managerial assessment of their work, but the form of the changes here appears to impact more substantially on history than on physics. Although physicists were concerned about quantitative assessments where these were unmediated by some peer judgement, the measures themselves were relatively familiar, focusing on academic journal publication, citations, a known journal hierarchy as well as quantity of output. For historians, many elements used in generic performance assessment templates seemed to do violence to their previous disciplinary norms. For example, the emphasis on research productivity, and competitive grants seems to require for many a reduction in the care they have previously given to teaching as a central part of what their field is about and how their contribution as historians is measured. In terms of research outputs, although books are still prized within

the field, they are difficult to quantify appropriately in templates that have been essentially derived from science norms of journal articles as the central mode of communication. And new performance measures expect annual quantified research outputs, not ones developed over a much longer time frame. Historians are concerned about the ways quantification is a poor measure of the differences of quality and effort in different articles and books. And they are confronted by the need to locate outputs in clear classificatory boundaries for the purposes of Australia's research quality assessment, ERA.

In terms of substantive emphases and priorities, this is a period in which there is a greater attempt to steer from above how both research and curriculum should be developed (new interdisciplinary subjects, for example; and national research priorities), but here too there is some difference in how history and physics are potentially impacted. The idea that physics is a specialised hierarchical form of study that needs to preserve adequate underpinnings is well understood, even if the specific claims for space in the curriculum are the subject of dispute when university-wide curriculum reforms are put in place. History is not seen as specialist in the same way and the implications for disciplinary education of beginning with a general interdisciplinary first year subject, or reducing the number of subjects, are likely to be seen only as special pleading by those outside the discipline. But a subject that is built by detailed substantive knowledge and learning of the craft, not by core models or theories, is affected by such changes. The changes may begin to build a new kind of interdisciplinary proto-discipline or may begin to break down the strong disciplinary identity we saw at work currently, but the changes are not neutral.

In Conclusion

We began this book with two questions, '*how should we think about knowledge today?*' and '*is the emphasis on learning outcomes and on auditing and managing education achievements in schooling and higher education distorting and undermining knowledge-building*?'. We chose to investigate these questions by studying one part of the knowledge spectrum, the disciplines of history and physics and their cognate subjects in schools. Our context was Australia.

Knowledge, in the way we have discussed it in this book, is not static. Disciplines change over time, disciplinary boundaries change, new disciplines or forms of study emerge. But the focus on disciplines helps us notice the specificities of different forms of knowledge and helps us consider knowledge development over time, both in terms of the historical underpinnings of the disciplined inquiry that continues now (and the productive as well as constraining qualities that are part of that) and in terms of the interactive relationship over time of the knowledge development that schools and higher education engage in.

New modes of governance and management in Australia are, as we discussed in this book, changing some of the conditions of knowledge work. Knowledge

work (teaching and research) always has conditions, and some of the recent developments are understandable and even productive in terms of the subjects we studied here. In the school curriculum the decision to move to a national 'Australian' curriculum at the very least led to a serious review and consideration of school knowledge today, with subject framing committees including voices from disciplines and teachers. In universities, some accountability and oversight was seen as positive (for example in relation to doctoral study, and in making opportunities for more junior academics). The Australian policy concern with outcomes, economic benefits, efficiencies and rankings, and the use of templates and quantification for management purposes, are not unusual by current international standards. But the particular form of these strategies in Australia does take a particularly strong, centralised, short-term oriented and micro-managed form. This study suggests that in relation to knowledge purposes some rebalancing towards greater local forms of flexibility and peer judgement would be desirable. There are unwitting effects on the substance of the practices of teaching and research in a number of current moves. In universities compliance and targets generate gaming and risk avoidance as much as apparent improvements in productivity. In school, the 'unwitting effect' of new bureaucracies and management at scale, and even the effect of creating a greater public conversation about the curriculum politically and via the creation of the *My School* website, can be to over-emphasise the utilitarian and crowded form of the curriculum. The changes can be to the detriment of schooling's educational role in drawing students into forms of knowledge different from the everyday and whose effects are longer rather than short-term.

Is knowledge 'at the cross-roads'? In the 1950s C. P. Snow (1959) wrote about the 'two cultures' of humanities and science and their problems in talking to each other. In the 1990s, Gibbons et al. (1994) talked of a 'new production of knowledge'. In many popular discussions today questions are raised about whether the internet and '21st century skills' are a replacement for rather than an addition to subject-specific knowledge. What we have tried to show in this book is what some of these perspectives give rise to as policy and governance conditions, and how they are currently being seen, negotiated and reframed on the ground by those who continue to think that history and physics matter.

References

Abbott, A. (2001). *Chaos of disciplines*. Chicago: The University of Chicago Press.

Altbach, P., Reisberg, E., & Rumbley, L. (2009). *Trends in global higher education: Tracking an academic revolution*. Paris: UNESCO.

Becher, T. (1989). *Academic tribes and territories: Intellectual enquiry and the cultures of disciplines.* Milton Keynes, UK; Bristol, USA: Society for Research into Higher Education; Open University Press.

Bell, S., & Yates, L. (2015). *Women in the science research workforce: Identifying and sustaining the diversity advantage*. Melbourne, VIC: L.H. Martin Institute.

Bernstein, B. (1971). On the classification and framing of educational knowledge. In M. F. D. Young (Ed.), *Knowledge and control: New directions for the sociology of education*. London: Collier Macmillan.

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research and critique*. London: Taylor and Francis.

Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3), 195–203.

Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 53*(3), 204–213.

Fensham, P. J. (2012). The science curriculum: The decline of expertise and the rise of bureaucratise. *Journal of Curriculum Studies, 45*(2), 152–168.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: the dynamics of science and research in contemporary societies*. London: Sage.

Gornitzka, Å., & Maassen, P. (2014). Dynamics of convergence and divergence: Exploring accounts of higher education policy change. In P. Mattei (Ed.), *University adaptation in difficult economic times*. New York: Oxford University Press.

Hood, C. (2006). Gaming in targetworld: The targets approach to managing British public services. *Public Administration Review, 66*(4), 515–521.

Keating, J. (2011). Vocational curriculum in Victorian secondary education: Reconciling continuity and innovation. In L. Yates, C. Collins, & K. O'Connor (Eds.), *Australia's curriculum dilemmas: State cultures and the big issues* (pp. 86–103). Carlton, VIC: Melbourne University Press.

Lake, M. (2011). *Submission to the TEQSA discussion paper, June 2011, 'Developing a framework for teaching and learning standards in Australian higher education and the role of TEQSA'*. Australian Historical Association. Retrieved from http://www.theaha.org.au/wp-content/uploads/2015/06/TEQSA_Discussion_Paper-submission.pdf

Lam, A. (2010). From 'ivory tower traditionalists' to 'entrepreneurial scientists'? Academic scientists in fuzzy university-industry boundaries. *Social Studies of Science, 40*(2), 307–340.

Lam, A. (2011). What motivates academic scientists to engage research commercialization: 'Gold', 'ribbon' or 'puzzle'? *Research Policy, 40*(10), 1354–1368.

Lamont, M. (2009). *How professors think: Inside the curious world of academic judgment*. Cambridge, MA: Harvard University Press.

May, R., Strachan, G., Broadbent, K., & Peetz, D. (2011). The casual approach to university teaching; time for a re-think? In K. Krause, M. Buckridge, C. Grimmer & S. Purbrick-Illek (Eds.), *Research and development in higher education: Reshaping higher education*, *34* (pp. 188–197). Milperra, NSW: Higher Education Research and Development Society of Australasia. Retrieved from http://www.herdsa.org.au/wp-content/uploads/conference/2011/papers/HERDSA_2011_May.PDF

Muller, J. (2009). Forms of knowledge and curriculum coherence. *Journal of Education and Work, 22*(3), 205–226.

Muller, J. (2015). The future of knowledge and skills in science and technology higher education. *Higher Education, 70*(3), 409–416.

Norton, A., Sonnemann, J., & Cherastidtham, I. (2013). *Taking university teaching seriously*. Melbourne, VIC: Grattan Institute. Retrieved from http://grattan.edu.au/report/taking-university-teaching-seriously/

Oliver, D., Freeman, B., Young, C., Yu, S., & Verma, G. (2014). *Employer satisfaction survey: Report for the Department of Education, June 2014*. Sydney: Workplace Research Centre, University of Sydney Business School. Retrieved from https://docs.education.gov.au/system/files/doc/other/ess_final_report_june_14_0.pdf

Snow, C. P. (1959). *The two cultures and the scientific revolution (the Sir Robert Rede Lecture)*. Cambridge: Cambridge University Press.

Verbeeten, F. H. M. (2008). Performance management practices in public sector organizations: Impact on performance. *Accounting, Auditing and Accountability Journal, 21*(3), 427–454.

Weingart, P. (2013). The loss of trust and how to regain it: Performance measures and entrepreneurial universities. In L. Engwall & P. Scott (Eds.), *Trust in universities* (pp. 83–95). London: Portland Press.

Woelert, P., & Millar, V. (2013). The 'paradox of interdisciplinarity' in Australian research governance. *Higher Education, 66*(6), 755–767.

Woelert, P., & Yates, L. (2015). Too little and too much trust: Performance measurement in Australian higher education. *Critical Studies in Education, 56*(2), 175–189.

Yates, L. (2012). My School, My University, My Country, My World, My Google, Myself… What is education for now? *Australian Educational Researcher, 39*(3), 259–274.

Young, M. (2008). *Bringing knowledge back in: from social constructivism to social realism in the sociology of education.* London: Collier MacMillan.

Appendix
Participant Data and Interview Protocols

The research project was sociological and interpretive in its design; broadly located within the academic fields of education policy sociology and curriculum inquiry, both of which are recognised as fields that must be assembled, addressed and defended discursively rather than through a template methodology. The project drew on analyses of policy and course documents, websites, submissions plus interviews carried out across three Australian states, and across elite and non-elite schools and universities with teachers, lecturers, and senior policy-makers. The project was not intended as a survey-style national mapping of responses but aimed to use semi-structured interviews that could provide close attention to meanings, both explicit and implicit; and to include in its interview cohort sufficient variation of geography, institutional types, and demographic characteristics of interviewees to encompass major possible variations.

The interview approach used open questions with the aim of understanding what the interviewees themselves think about and prioritise, and to try to understand the terms in which they are thinking, rather than directly initiating a probe about say the effects of increased accountability regimes. All interviews were carried out by one of the four researchers who are the authors of this book, then were transcribed and analysed in a number of different ways, drawing in the process on feedback from workshops and conferences, and, where appropriate, using qualitative analysis software as a tool. The orientation of this project was not to give an account of who are history and physics teachers and academics today; it was to attend to 'what is happening to knowledge today?' by listening to what these interviewees say. In addition to interviews with teachers and academics working in the two disciplinary fields, we included a range of interviews with individuals representing executive level oversight of teaching and research, and leaders of their relevant professional bodies in Australia.

In following sections we include a table of the demographic details of the interviewees, and the interview protocols we used.

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Participant Demographics

Project interviews were conducted between September 2011 and April 2013. They comprised 115 semi-structured interviews with academics and teachers working at Australian educational institutions, each approximately an hour in length. Of the 115 individuals interviewed, 53 were academics, 56 were teachers, and a further 6 were heads and discipline leaders of professional associations such as the *Australian Curriculum Assessment and Reporting Authority* (ACARA), the *Australian Historical Association* (AHA), and the *Academy of the Social Sciences in Australia* (ASSA).

Of those working in universities, we interviewed 23 historians, 27 physicists and 3 members of senior management with responsibilities for curriculum working at Australian universities, including a former Academic Programs Committee Chair, a Pro Vice Chancellor (Graduate Research) and a Dean of Learning and Teaching. Of the 53 academics interviewed, 35 were located at research-intensive *Group of Eight* (Go8) universities and 18 were located at other universities. The interviews were spread across the eastern states with 31 participants located in Victoria, 13 located in NSW and 9 located in Queensland.

Participants included academics at all academic levels (2 at Level A, 15 at Level B, 7 at Level C, 12 at Level D and 17 at Level E), and both early career and senior members of staff (24 participants had obtained their PhD more than 20 years ago, 14 between 11 and 20 years, 11 between 6 and 10 years and 4 in the last five years). Most were in teaching and research roles (28), while others also held university management positions such as Head of Department (17), or were on research only fellowships (6) or were casually employed (2). Twenty-two of the physicists interviewed were male and only 5 female, while in history we interviewed 14 men and 9 women (the 3 remaining interviewees with broader curriculum responsibilities at their institution were male).

In relation to school teachers, we interviewed 28 history teachers, 23 physics teachers and 5 teachers with responsibilities for curriculum management and oversight at their school. Of the teachers interviewed, 30 were working at schools in Victoria, and 13 teachers were from schools in each of NSW and Queensland. We interviewed 24 teachers from non-selective state schools, 12 teachers from selective state schools or state schools with a selective academic stream, 14 teachers from independent schools, and 4 teachers from Catholic schools. Two other teachers were currently working for subject associations. Most of the teachers interviewed were senior (40 compared with 16 junior teachers). 30 of the interviewed teachers were male and 26 female.

Participant Details

In this book, we have referred to our interview participants by the interview number. The table below provides further details on the background of each participant which may not have been provided in the text.

Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Academic 1	15/09/11	Female	Physics	Go8 University	University Management	Level D	Victoria
Academic 2	4/10/11	Female	History	Go8 University	Teaching and Research Academic	Level E	Victoria
Academic 3	5/10/11	Male	Physics	Go8 University	University Management	Level E	Victoria
Academic 4	12/10/11	Male	Physics	Go8 University	University Management	Level E	Victoria
Academic 5	31/10/11	Female	History	Go8 University	Casual Academic	Level A	Victoria
Academic 6	2/11/11	Male	Physics	Go8 University	Teaching and Research Academic	Level D	Victoria
Academic 7	4/11/11	Male	History	non-Go8 University	University Management	Level E	Victoria
Academic 8	9/11/11	Male	History	Go8 University	Teaching and Research Academic	Level D	Victoria
Academic 9	14/11/11	Female	History	Go8 University	Casual Academic	Level A	Victoria
Academic 10	15/11/11	Male	Curriculum	Go8 University	University Management	Level D	Victoria
Academic 11	15/11/11	Female	History	non-Go8 University	Teaching and Research Academic	Level C	Victoria
Academic 12	18/11/11	Male	Physics	Go8 University	Fellowship (Research Only)	Level E	Victoria
Academic 13	18/11/11	Male	Physics	Go8 University	Teaching and Research Academic	Level E	Victoria
Academic 14	5/12/11	Female	History	Go8 University	Teaching and Research Academic	Level E	Victoria
Academic 15	6/12/11	Female	Physics	non-Go8 University	Fellowship (Research Only)	Level B	Victoria
Academic 16	7/12/11	Female	Physics and Curriculum	Go8 University	University Management	Level D	Victoria
Academic 17	29/02/12	Female	Physics	Go8 University	University Management	Level D	NSW
Academic 18	1/03/12	Male	Physics	Go8 University	University Management	Level E	NSW
Academic 19	12/03/12	Male	Curriculum	Go8 University	University Management	Level E	Victoria

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Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Academic 20	15/03/12	Male	History	Go8 University	University Management	Level E	NSW
Academic 21	15/03/12	Female	History	Go8 University	Teaching and Research Academic	Level C	NSW
Academic 22	15/03/12	Male	Physics	Go8 University	Teaching and Research Academic	Level E	NSW
Academic 23	15/03/12	Male	Physics	Go8 University	Teaching and Research Academic	Level D	NSW
Academic 24	19/03/12	Male	History	non-Go8 University	University Management	Level E	Victoria
Academic 25	27/03/12	Male	History	non-Go8 University	Teaching and Research Academic	Level B	Victoria
Academic 26	27/03/12	Male	History	non-Go8 University	Teaching and Research Academic	Level B	Victoria
Academic 27	30/03/12	Male	Curriculum	non-Go8 University	University Management	Level E	Victoria
Academic 28	12/04/12	Male	History	non-Go8 University	University Management	Level E	Victoria
Academic 29	17/04/12	Male	History	non-Go8 University	University Management	Level D	Victoria
Academic 30	26/04/12	Male	Physics	Go8 University	Teaching and Research Academic	Level D	Queensland
Academic 31	26/04/12	Male	Physics	Go8 University	Teaching and Research Academic	Level B	Queensland
Academic 32	26/04/12	Male	Physics	Go8 University	University Management	Level C	Queensland
Academic 33	26/04/12	Male	Physics	Go8 University	Teaching and Research Academic	Level D	Queensland
Academic 34	8/06/12	Male	History	Go8 University	Teaching and Research Academic	Level B	Victoria
Academic 35	6/07/12	Male	History	Go8 University	Teaching and Research Academic	Level E	Victoria
Academic 36	10/07/12	Male	Physics	Go8 University	Teaching and Research Academic	Level B	Queensland
Academic 37	11/07/12	Male	History	non-Go8 University	Teaching and Research Academic	Level B	Victoria
Academic 38	16/07/12	Male	Physics	Go8 University	Teaching and Research Academic	Level D	Victoria
Academic 39	16/07/12	Male	Physics	Go8 University	Teaching and Research Academic	Level C	Victoria
Academic 40	26/07/12	Male	Physics	non-Go8 University	University Management	Level D	NSW
Academic 41	27/07/12	Female	History	non-Go8 University	Fellowship (Research Only)	Level B	NSW

(continued)

(continued)

Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Academic 42	12/09/12	Male	Physics	Go8 University	University Management	Level E	NSW
Academic 43	13/09/12	Female	Physics	Go8 University	Teaching and Research Academic	Level C	NSW
Academic 44	14/09/12	Female	History	non-Go8 University	Teaching and Research Academic	Level B	NSW
Academic 45	14/09/12	Male	History	non-Go8 University	Teaching and Research Academic	Level B	NSW
Academic 46	14/09/12	Male	Physics	non-Go8 University	Teaching and Research Academic	Level C	NSW
Academic 47	15/10/12	Male	History	non-Go8 University	Fellowship (Research Only)	Level B	Victoria
Academic 48	14/11/12	Male	Physics	non-Go8 University	Teaching and Research Academic	Level E	Queensland
Academic 49	14/11/12	Male	History	Go8 University	Teaching and Research Academic	Level B	Queensland
Academic 50	15/11/12	Female	History	Go8 University	Teaching and Research Academic	Level B	Queensland
Academic 51	16/11/12	Male	Physics	non-Go8 University	Teaching and Research Academic	Level C	Queensland
Academic 52	5/04/13	Male	Physics	Go8 University	Fellowship (Research Only)	Level B	Victoria
Academic 53	9/04/13	Male	Physics	Go8 University	Fellowship (Research Only)	Level B	Victoria
Academic Professional Association 1	14/03/13	Male	History	Go8 University	Professional Association	Level E	n/a
Academic Professional Association 2	18/03/13	Female	History	non-Go8 University	Professional Association	Level E	n/a
Academic Professional Association 3	18/03/13	Male	History	Go8 University	Professional Association	Level D	n/a
Academic Professional Association 4	25/03/13	Female	History	non-Go8 University	Professional Association	Level E	n/a
Academic Professional Association 5	8/04/13	Male	Curriculum	Go8 University	Professional Association	Level E	n/a
Academic Professional Association 6	17/04/12	Male	Science Education	non-Go8 University	Professional Association	Level E	n/a
Teacher 1	21/11/11	Female	History	Private school	Classroom Teacher	Senior	Victoria

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Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Teacher 2	21/11/11	Female	Physics	Private school	Classroom Teacher	Junior	Victoria
Teacher 3	23/11/11	Female	History	State school	Classroom Teacher	Junior	Victoria
Teacher 4	6/12/11	Female	Curriculum	State school	School Management	Senior	Victoria
Teacher 5	6/12/11	Male	Physics	State school	Classroom Teacher	Junior	Victoria
Teacher 6	5/12/11	Male	Physics	State school	Classroom Teacher	Senior	Victoria
Teacher 7	5/12/11	Female	History	State school	Classroom Teacher	Senior	Victoria
Teacher 8	9/12/11	Male	History	State school (selective stream)	Classroom Teacher	Senior	Victoria
Teacher 9	1/03/12	Male	History	Professional Association	Classroom Teacher	Senior	NSW
Teacher 10	1/02/12	Male	Physics	Selective state school	School Management	Senior	NSW
Teacher 11	1/03/12	Male	Physics	Selective state school	Classroom Teacher	Senior	NSW
Teacher 12	2/03/12	Male	Physics	Selective state school	Classroom Teacher	Senior	NSW
Teacher 13	2/03/12	Male	Physics	Selective state school	Classroom Teacher	Senior	NSW
Teacher 14	2/03/12	Male	History	Selective state school	Classroom Teacher	Senior	NSW
Teacher 15	8/03/12	Female	Curriculum	State school (selective stream)	School Management	Senior	Victoria
Teacher 16	11/03/12	Male	Physics	State school	School Management	Senior	Victoria
Teacher 17	27/04/12	Male	History	Private school	School Management	Senior	Queensland
Teacher 18	27/04/12	Female	History	Private school	School Management	Senior	Queensland
Teacher 19	27/04/12	Male	History	Private school	Classroom Teacher	Senior	Queensland
Teacher 20	11/05/12	Male	History	Catholic school	Classroom Teacher	Junior	Victoria
Teacher 21	11/05/12	Male	Physics	Catholic school	Classroom Teacher	Senior	Victoria
Teacher 22	21/05/12	Female	Physics	Catholic school	Classroom Teacher	Senior	Victoria
Teacher 23	24/05/12	Male	Curriculum	State school	School Management	Senior	Victoria
Teacher 24	24/05/12	Female	History and Curriculum	State school	School Management	Senior	Victoria
Teacher 25	24/05/12	Male	Physics	State school	Classroom Teacher	Senior	Victoria

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Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Teacher 26	28/05/12	Female	Physics	State school	Classroom Teacher	Junior	Victoria
Teacher 27	31/05/12	Female	Physics	State school	Classroom Teacher	Senior	Victoria
Teacher 28	12/07/12	Female	History	State school	Classroom Teacher	Senior	Queensland
Teacher 29	12/07/12	Male	History	State school	Classroom Teacher	Senior	Queensland
Teacher 30	12/07/12	Male	Physics	State school	Classroom Teacher	Junior	Queensland
Teacher 31	12/07/12	Male	Physics	State school	Classroom Teacher	Unclear	Queensland
Teacher 32	12/07/12	Male	History	State school	Classroom Teacher	Junior	Queensland
Teacher 33	12/09/12	Female	History	Private school	School Management	Senior	NSW
Teacher 34	12/09/12	Female	History	State school	Classroom Teacher	Senior	NSW
Teacher 35	13/09/12	Male	Physics	Selective state school	Classroom Teacher	Senior	NSW
Teacher 36	20/09/12	Female	History	Professional Association	Classroom Teacher	Junior	Victoria
Teacher 37	17/10/12	Male	History	State school	Classroom Teacher	Junior	Victoria
Teacher 38	24/10/12	Male	Physics	Private school	Classroom Teacher	Senior	Victoria
Teacher 39	24/10/12	Female	History	Private school	Classroom Teacher	Senior	Victoria
Teacher 40	7/11/12	Female	Physics	Casual relief	Classroom Teacher	Junior	Victoria
Teacher 41	7/11/12	Male	Curriculum	Private school	School Management	Senior	Victoria
Teacher 42	9/11/12	Female	Physics	State school	Classroom Teacher	Junior	Victoria
Teacher 43	15/11/12	Female	History	Private school	Classroom Teacher	Senior	Queensland
Teacher 44	20/11/12	Male	Physics	Private school	Classroom Teacher	Senior	Victoria
Teacher 45	23/11/12	Male	History	State school	Classroom Teacher	Junior	Victoria
Teacher 46	27/11/12	Female	History	Private school	Classroom Teacher	Junior	Victoria
Teacher 47	13/12/12	Female	History	Private school	Classroom Teacher	Senior	Victoria
Teacher 48	25/03/13	Female	History	Catholic school	Classroom Teacher	Senior	NSW
Teacher 49	26/03/13	Female	History	State school	Classroom Teacher	Senior	NSW
Teacher 50	26/03/13	Male	History	Private school	Classroom Teacher	Senior	NSW
Teacher 51	5/04/13	Female	History	State school (selective stream)	Classroom Teacher	Junior	NSW
Teacher 52	19/04/13	Female	History	State school	Classroom Teacher	Junior	Queensland

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Participant	Date of interview	Gender	Discipline	Institutional affiliation	Position	Seniority	State
Teacher 53	19/04/13	Male	Physics	Selective state school	Classroom Teacher	Senior	Queensland
Teacher 54	19/04/13	Male	Physics	Selective state school	Classroom Teacher	Senior	Queensland
Teacher 55	19/04/13	Male	Physics	Selective state school	Classroom Teacher	Senior	Queensland
Teacher 56	25/11/11	Female	Curriculum	State school	School Management	Senior	Victoria

The Interview Questions

Our interviews were semi-structured, guided by a list of interview questions focused on (a) the interviewees' own educational background (and research focus if applicable); (b) their thoughts about their discipline and the interdisciplinarity agenda; (c) their current work and their experiences of change; and (d) the ways their work is impacted upon by changing institutional and policy contexts. A full list of the questions to academics and teachers is provided below. Details in square brackets indicate issues to be probed by interviewer if not included in the initial open-ended response by the interviewee.

Academic Interview Questions

(1) The educational and research background of the interviewee
- Tell us a bit about your own (educational) background, and about what attracted you to studying and working in history/physics? [Schools and universities attended]
- What kind of research are you doing?
- Would you consider yourself to be a historian/physicist

(2) Thinking about the discipline
- Do you think of history/physics as a distinct field of study or discipline? If you do, what do you think characterises it? [key concepts/methodologies/objects of study]
- In the time since you began studying, do you think the discipline itself has changed much?

(3) The current role and work of the interviewee
- What is your current role and what is the range of the work you are doing now (in terms of teaching, research and administrative responsibilities)?
- *Questions on teaching*:
  - What subjects, years and levels are you teaching?
  - What guides the development, teaching and assessment of subjects in this field?

  - Thinking about the courses that are taught in your department, how much, in your view, are they directed toward building knowledge in your discipline, and how much toward more generic agendas?
  - What do you hope your students will take away from your own subjects?
- *Questions on research supervision*:
  - Moving on to research supervision, do you think you convey a different sense of what history/physics is compared to at the undergraduate level?
  - How defined or fluid are the boundaries of what history/physics is at that research level? [interdisciplinarity]
  - Are there any particular developments within this university or across the university sector affecting research supervision [accountability or autonomy]?
- *General questions*:
  - Thinking about knowledge-building in history/physics, what kind of things should be done at the school, the undergraduate and the postgraduate research level?
  - Where do you think interdisciplinary work is best done in the overall education and research trajectory?
  - There has been a lot of discussion around interdisciplinarity in research and teaching? Where do you think this is coming from?
  - How is your performance as an academic judged and measured and how has this changed over time?
  - Do you think these assessment procedures are adequate in capturing what you do/are trying to achieve? And are they influencing your work? [If so, how?]

(4) Their thoughts about the future of their discipline?
- What do you see as the future of your discipline in Australia or are there any developments you would like to see?

Teacher Interview Questions

(1) The educational background of the interviewee
- Tell us a bit about your own (educational) background, and about what attracted you to teaching in history/physics?

(2) Thinking about the discipline
- Do you think of history/physics as a distinct field of study or discipline? If you do what characterises it? [key concepts/methodologies/objects of study]
- When you were studying at university, could you easily identify characteristics specific to or associated specifically with your discipline? Or did this seem to change across different subjects within that discipline?
- Do you think there's something specifically valuable about your discipline or subject?

(3) The current role and work of the interviewee

- What is your current role and what is the range of work you are doing now (in terms of teaching and administrative responsibilities)?
- *Questions on teaching (preface these questions by suggesting that if the participant is teaching at 7–10 and senior secondary that they may want to consider each in their responses)*:
  - How much input do you and your colleagues have into the content of curriculum and forms of assessment for your subjects and how much are these already prescribed by internal or external guidelines?
  - Thinking about the subjects you teach, how much, in your view, are they directed toward building knowledge in your discipline, and how much toward more generic agendas?
  - What do you hope your students will take away from your subjects
  - Does the kind of school you work in impact on the nature of your teaching in your discipline?
  - Are the staff at this school arranged into disciplinary areas? (Do you have subject department meetings?)
- *General questions*:
  - Thinking about knowledge-building in history/physics, what kind of things should be done in years 7–10, and what kinds of things at senior secondary and at university?
  - How do you see the move to the Australian curriculum influencing curriculum at the school and in your own subject areas?
  - Where do you think interdisciplinary work is best done in the overall educational trajectory?
  - How is your own performance assessed? What kinds of accountabilities do you have and have they changed over time?

(4) Their thoughts about the future of their discipline?

- What do you see as the future of your discipline in Australia?
  - If not mentioned ask about the impact of the national curriculum.
- Are there any developments you see as likely in the near future, or that you would like to see?

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