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.

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