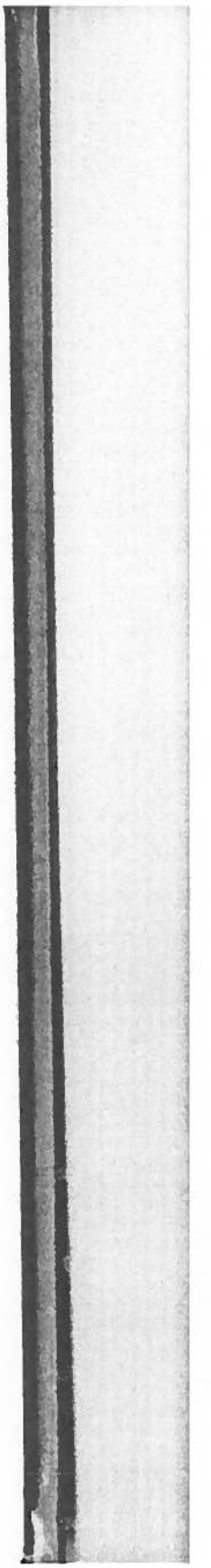
Paul Gibbs · Ronald Barnett
Editors

Thinking about Higher Education



Springer

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ISBN 978-3-319-03253-5 ISBN 978-3-319-03254-2 (eBook)
DOI 10.1007/978-3-319-03254-2
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013954564

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Contents

Part III Which Knowledge and Who Can Have It

Contributors

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Leesa Wheelahan is an Associate Professor at the LH Martin Institute for Tertiary Education Leadership and Management and the Melbourne Graduate School of Education at the University of Melbourne. She has published widely on tertiary education policy, relations between the vocational education and higher education sectors, student equity and the role of knowledge in curriculum. She is a member of the editorial boards of seven international journals and the Author of *Why Knowledge Matters in Curriculum: A Social Realist Argument* (Routledge). Her current work focuses on exploring the nature of and the conditions for the creation of knowledge in professions and occupations and on improving pathways within and between education and work.

Part III
Which Knowledge and Who Can Have It

Babies and Bathwater: Revaluing the Role of the Academy in Knowledge

Leesa Wheelahan

Introduction

Higher education is being changed in two ways. First, it is becoming more utilitarian and specifically vocational as a consequence of the dominance of economic values in contemporary society and policy which subordinates higher education and its institutions as instruments of micro-economic policy. Second, the rhetoric of 'the knowledge society' seems to undermine the distinctiveness of 'higher' education and its institutions. Both processes contribute to undermining the academic disciplines and their location within institutions of higher education. The irony is that prosperous, socially inclusive, knowledge rich societies rely on the store of knowledge developed, codified, curated and transmitted by higher education institutions. More fundamentally, they rely on an understanding of the nature of knowledge and of the means of its generation—research—which are undermined by utilitarianism and by the genericism posited by the knowledge society.

There is a creative tension between academic disciplines on the one hand, and inter-disciplinary research that focuses on a particular problem on the other that requires insights from many different disciplines. Interdisciplinary research requires the disciplines as a condition of its existence, but the disciplines on their own cannot 'solve' complex problems that are the result of many different interacting causal factors. A discipline cannot claim to explain the *whole* world, just an aspect of the world and quite imperfectly at that. Problems arise in the academic disciplines in attempts to unproblematically translate findings from the 'pure' academic disciplines to real, messy, complexities—processes of translation and integration by more applied disciplines are required (Collier 1997; Bhaskar 2010). However while this is so, in undermining the academic disciplines, proponents of 'useful' knowledge are undermining the conditions for the development of knowledge.

The chapter focuses on the arguments for transdisciplinarity made famous by Gibbons and his colleagues (Gibbons 2004b, 2005; Nowotny et al. 2001) who argue that disciplinary structures are a constraint on the development of knowledge. They distinguish between Mode 1 knowledge which is largely disciplinary based, and Mode 2 knowledge which (they argue) transgresses disciplines and is contextual, problem oriented research that occurs at the site of application. Gibbons (2008, p. 2) distinguishes between transdisciplinary knowledge on the one hand and interdisciplinary or multidisciplinary knowledge on the other, because unlike the latter, the former is "not necessarily derived from pre-existing disciplines". Rather, he argues that transdisciplinary knowledge is constructed through the 'boundary object'—the common object or purpose that brings researchers and other 'key stakeholders' together.

First, the chapter draws on the philosophy of critical realism to establish the ontological basis for understanding how knowledge is produced and the role of the academic disciplines. This is followed by an analysis of Gibbons' and his colleagues arguments for Mode 1 and 2 knowledge. The final section uses critical realism and the sociology of Basil Bernstein to consider the implications for higher education universities, curriculum and students and for education for the professions.

A Critical Realist Argument

Critical realism distinguishes between the world and our knowledge of it. It argue that the world does not depend on what we think about it or know about it. Critic realists argue that the natural world exists independently of our conceptions of i although our actions may change aspects of the natural world as exemplified throug the consequences of human activity resulting in global warming. In contrast, th social world is *relatively* independent of our conceptions; our purposeful activiti may change aspects of the social world, but we operate within parameters that ha been shaped by previous agential actions (Archer 2000). However, our knowledge the natural and social worlds is fallible and provisional because our experience of th world is always theory-laden (though not theory determined) (Sayer 2000).

Critical realism is a relational theory of ontology that argues that the (natural a social) world is complex and stratified and characterised by emergence and cor plexity (Bhaskar 1998a, b). It distinguishes between 'causal mechanisms' (such gravity in the natural world and social class in the social world) which interact open systems so that their propensities to act in particular ways may be realise changed or impeded. This is the level of the real, the level of causal mechanism The next is the level of the actual, where events actually happen. We may or m not be able to perceive these events, but that doesn't mean they have not occurr (such as a tree falling in the forest). The third level is the level of the empirical

contrasting insights the gods in Valhalla bring to understanding why a strike is on at a particular factory. He explains that Thor provides the physical description of why things have stopped in the factory but he needs Woden to analyse the social realities and to tell him there is a strike on, whereas Fey, the god of biology and Loki, the god of unconscious are needed to explain that "the boss's daughter is going to elope with the chief shop steward, the boss is going to die of apoplexy, and the daughter [will] inherit the firm and turn it into a workers' co-operative".

A critique that critical realism makes of 'conventional science' is that it depends on counting how many times things happen (or the constant conjunction of events) as a key criterion for identifying causal laws and mechanisms. In contrast, critical realists seek to identify causal mechanisms and how they interact in open systems and this shows that things *could* happen but don't always happen. For example, Sayer (1992, p. 110) says that we don't need to explode neutron bombs to know their causal liabilities. Sayer (2000, p. 11) explains that "Realists therefore seek to identify both necessity and possibility or potential in the world—what things must go together, and would could happen, given the nature of the objects".

The Nature of Knowledge and the Disciplines

Critical realists regard knowledge as a social product that emerges through our practice in the world. They distinguish between the intransitive dimension which refers to the existence of the natural and social worlds and the transitive dimension which refers to our knowledge of these worlds. While objects and our knowledge of objects are causally related, there isn't a direct correspondence between the two and each can change independently of the other. Our knowledge is always mediated by pre-existing concepts and knowledge and by the social conditions of our access. There is no direct correspondence between the two because knowledge is socially produced and mediated, and has its own conditions for its existence and causal properties. It requires communities of knowledge producers (such as in the disciplines) with criteria for and consensus about how knowledge is produced (at least in some measure) which includes judging the validity of knowledge claims.

Collier (1997, p. 22) argues that 'abstract' academic disciplines provide insights into *aspects* of the world by identifying causal mechanisms in isolation of their operation in open systems. These disciplines are abstract sciences (as in the case of physics, chemistry and biology) because they abstract particular structures and causal mechanisms to demonstrate their actions, "*other things being equal*" (Collier 1997, p. 22). He says they can't predict how things happen in the real world because all other things never are equal. Bhaskar (2010, pp. 11–12) explains that "intermediate and concrete sciences sit between the abstract sciences and the reconstructed concepts of concrete objects." Concrete sciences use as their organising framework the object of study, whereas intermediate sciences study the con-

systems (Collier 1997, 1998). Collier makes a further distinction between concrete sciences (in which he includes the human sciences and some natural sciences) and *practices* which are individuated "by the aims that they pursue and the means they use." He gives agriculture, health care and war as examples of practice.

Collier (1997, p. 26) argues that concrete sciences should draw on abstract sciences (as well as their research on their own intransitive objects), while practices should draw on concrete sciences. He contrasts his preferred sequence "*abstract sciences—concrete science—practice*" to "the abridged sequence *abstract science—practice*" (Collier 1997, p. 26 emphasis in original). This is because abstract sciences are often used directly to inform practice, but the abstract sciences are based on abstracting causal mechanisms and identifying their propensities to act in particular ways, all other things being equal. But, as explained above, all other things never are equal. He gives as an example a discovery in the abstract sciences that may result in cheaper and quicker production of commodities, but at the expense of environmental devastation, or impairment of workers' health and well-being. He argues postmodern criticisms of the misuse of abstract sciences "lies not with abstract science but with the tendency of its commercial and military users to apply science in its abstract state, rather than treating abstract sciences as contributory disciplines whose results must flow together into the sea of concrete science before they are in a fit state to be applied practically" (Collier 1997, p. 26).

Collier's argument carefully distinguishes between different types of academic disciplines and explains the relationships between them. It shows that the 'pure' abstract disciplines are fundamental to our understanding of the world, but for *aspects* of the world. Concrete sciences or disciplines are needed to understand complex realities, and even here, concrete sciences often need to work together with each other and with the pure disciplines. Each is essential. Each requires institutional structures and cultures to support, develop, codify, curate and transmit knowledge. This role has traditionally been played by universities, although not exclusively. The development of the 'knowledge society' has seen the proliferation of sites of knowledge production outside the academy (Bernstein 2000), but this does not diminish the role of universities as society's method for institutionalising the development and structuring of knowledge. However, if the focus is on producing 'useful' knowledge for direct application, whilst at the same time attacking the pure disciplines for lack of relevance, a key enabling resource for 'useful' knowledge is being undermined.

Mode 1 and 2 Knowledge and Society

Gibbons (2004a, 2005, 2008) and Nowotny et al. (2001, 2003) define Mode 1 knowledge as disciplinary based, often 'pure' research, conducted in universities by disciplinary specialists within a hierarchical framework that specifies the rules for knowledge creation, what counts as knowledge and who can contribute to it. They contrast this with Mode 2 knowledge which is categorised by "a distinct set of cognitive and social practices" suitable for cross-disciplinary, problem oriented, applied

and less hierarchical research that occurs at the site of application, and which is, as a consequence, "more socially accountable and reflexive" than is Mode 1 knowledge (Gibbons 1997, p. 3). Mode 2 knowledge is created in many sites, and not just the university. It does not privilege the university as the sole site of knowledge creation.

Gibbons (2005) says the old social contract between society and science has changed. The old social contract depended on a distinction between the two and a division of labour between universities and society. Under the terms of the old contract, science was seen as the means for growth, control and predictability and was characteristic of "high modernity with its unshakeable belief in planning (in society) and predictability (in science)" (Nowotny et al. 2001, p. 5). Gibbons (2005, p. 6) explains that the role of science was to produce knowledge and communicate it to society. Under the old social contract, the communication was one-way, with science speaking to society.

Gibbons and Nowotny et al. argue that the success of this model altered the relationship between society and society and led to a new social contract. The success of science meant that it was increasingly brought into new domains and asked to solve new problems, many of which were not able to be addressed through existing disciplinary structures (Gibbons 2005). Science no longer has a one way dialogue with society—society now speaks back to science, by setting priorities, questions and problems to be solved, and by changing the social and institutional context in which science is practiced. They argue that as a consequence, both society and science have changed and there is a new relationship between them. Further, the discrete domains of politics, culture, the market, science and society under modernity "have become transgressive arenas, co-mingling and subject to the same co-evolutionary trends" (Nowotny et al. 2001, p. 4).

They argue that the economic and social changes which have transformed the relationship between science and society include the pervasive introduction of market policies, globalisation and consequent limits to the state. Knowledge production is now shaped by "the strategic policies of both industry, government and the research councils, [which] have been increasingly driven by a variety of socio-economic demands, involve a more diverse range of research competences, and exhibit many more cross-institutional links" (Gibbons 2005, p. 7). Moreover, these broad social, economic and political changes were also expressed through changes to intellectual cultures through challenging social conditions of equilibrium, normative stability and the scientific order.

Nowotny et al., argue that the *context* of application now provides the conditions for the development of robust science, not the traditional *methods* of science. Moreover, because contexts are now transgressive as a consequence of the previous boundaries between domains in society becoming permeable, overlapping and mutually constitutive, the previous disciplinary distinctions provide a constraint on the development of new knowledge. Robust science must respond to these new conditions, which have been brought about by the growth of complexity. They argue that a dynamic of co-evolution links society and science and changes each in the process, resulting in similarities between the two "in the operation of underlying forces" (Nowotny et al. 2001, p. 33).

These 'underlying forces' may be best understood as clusters of "perceptions, attitudes, outlooks, assumptions and rationalities" that "coalesce with altered social practices and institutional constraints" which are linked through a self-organising mode and not through simple cause and effect relationships (Nowotny et al. 2001, p. 33). Society is now characterised and shaped by: uncertainties in science and society; science as a driving force of economic competitiveness; economic rationality as the filter for priorities; a temporal dimension with the 'future as extended present'; the flexibilisation of distance as a consequence of information and communication technologies and globalisation which has contributed to both centralisation and decentralisation, and altered identities (see also Giddens 2000; Castells 2000); and, the self-organising capacity of science and society founded on reflexivity.

On the face of it, this seems to be an impeccable critical realist analysis of stratification and emergence. However, they flinch from following their analysis through to its logical conclusion and argue that "it would be wrong to aspire to identify common patterns of causality" (Nowotny et al. 2001, p. 30). They don't explain *why* it would be wrong, and nor do they explicitly spell out a theory of ontology even though their arguments about epistemology rest upon implicit assumptions about the nature of the real.

Reflexivity and Audit

Nowotny et al. identify the self-organising capacity of science and society as the most important characteristic of Mode 2 society. This is founded on a reflexivity which permeates all aspects of life. Reflexivity results in increasingly complex internal systemic differentiation that consequently increases the capacity of systems to engage with an increasingly complex environment in iterative and fluid ways at different levels, including the local. They argue that there is a second sense in which reflexivity constitutes a mutually iterative and constitutive process between science and society, and that is the emergence of the 'audit society' as the means of managing risk in the context of inherent uncertainty. This new mode of organisation is effective (they argue) because it internalises forms of behaviour in a context where old methods of social control are increasingly ineffective. It preserves relative autonomy for the scientific community while ensuring it is responsive to society's needs.

> In the absence of the active participation of those who are to be audited, and without an internalized institutional self-discipline, social control is ineffective. It can even be argued that, in the shift towards an audit and accountability culture (which can be regarded as forms of institutional reflexivity), an element of authenticity enters. The self, or the organization, is expected to conspire in its own surveillance. Social control is internalized and so transformed into self-control. At the same time it also becomes possible to shift from process to outcome. (Nowotny et al. 2001, pp. 45–46)

This extraordinary analysis sets the scene for an argument that the collective and collegiate forms of social organisation founded in the disciplines is a constraint (on trade?), that the methods of the sciences (or the epistemological core) no

longer result in 'robust' science, that new social forms are needed to bring society and science together (the market), and that this will result in responsive research. Science must now be relevant. How is relevance determined? Through the mechanism of supply and demand in the market place of knowledge. While it may be a 'metaphorical' market, it nonetheless elicits "the individualized and individualizing beliefs, values and norms upon which the functioning of any market is premised" (Nowotny et al. 2001, p. 107).

This leads to an argument in which Western individualism is now the new mediator between science and society. Communitarian philosophies result (they argue) in strong in/out group relations, tight and shared norms and less internal differentiation, and segregation between different disciplines. In contrast, individualism results in more integration because people are not constrained by tight in/out group relations or shared norms and approaches and they are more likely to engage (through the market) with others, and are also more likely to be responsive to the needs of others. Unlike traditional models, this creates 'spaces' for individuals, groups and organisations that were previously excluded. This is, they argue, a desirable outcome.

Bernstein (2000) presents as a dystopia a world in which 'inner commitments' to a field of knowledge is severed, and the use-value of knowledge eclipsed by its exchange value as a consequence of the commodification of knowledge through its subordination to the market. For Nowotny et al., it seems to be the reverse, through an almost Hegelian unfolding of the rational spirit towards self-realisation (Heywood 1999), except it is the market and not the state that expresses this self-realisation.

TINA: There is no Alternative

Because Nowotny et al. do not have a theory of ontology they present an historicist and teleological account of the development of science and knowledge, reducible only to social relations. Consequently, they run the teleological TINA argument—there is no alternative—which leads them to argue that the driving force of science and innovation is markets and individual competitiveness. They do not find the basis of science in the nature of the objects of science, but in the *cultural practices* of science, which leads them to argue that epistemological core at the heart of science is empty:

> or, more accurately, that the epistemological core is crowded with many different norms and practices which cannot readily be reduced to generic methodologies or, more broadly, privileged cultures of scientific inquiry. (Nowotny et al. 2001, p. 199)

They achieve this through presenting a straw person in the form of positivist science, and counterpose their model of 'robust' science. For example, Gibbons (2005, pp. 8–9) cites research into deep vein thrombosis to illustrate his argument. He says that research on DVT conducted in laboratories on fit young people found no correlation between DVT and air travel when tested at 6,000 ft for relatively short times. He contrasts this to research on actual populations with

diverse medical histories who fly in cramped spaces at 35,000 ft for up to 15 h The former produced reliable but not robust research. However, the former model also describes atomistic, positivist science, which reduces causation to constant conjunctions of events. The latter approach identifies causal mechanisms operating in open systems. This is not an argument for individualism and competitiveness in science, but an argument against positivism. Similarly, Nowotny et al. find the basis of objectivity in the *methods* of science and not in the relationship between knowledge and its object. This leads them to argue for science that is more subjective and epistemologically eclectic.

There are many problems with the approach that Nowotny et al. outline. First because they lack a theory of ontology, they reduce knowledge to knowers and their cultural practices, rather than the product of practical engagement in a stratified and complex world. This leads them to substitute the culturally and historically specific forms of social organisation expressed through markets (Bourdieu and Wacquant 1992) as the normative ideal and the inexorable reality (TINA). Second, as they concede, given that economic rationality and individualism pervades Mode-2 society there are "acute issues of social justice, economic equality and the further democratization of knowledge" (Nowotny et al. 2001, p. 252). Third, in presenting market relations as the integrative force, the danger is that the market will be seen as the only arena for identifying research problems, and this excludes or makes more difficult public investment in public issues such as global warming. In essence, they have used a pluralist view of politics in which the diffusion of political, social and economic power through interest group competition is the normative ideal (Schwarzmantel 1987). This approach is not able to account for socially differentiated capacities to identify and constitute concerns and interests, nor for the way in which power is exercised (Lukes 1974). Fourth, in rejecting positivist science and in not articulating a non-relativist epistemology based on a materialist ontology they are left with pragmatism or instrumentalism, in which 'what works' is the guiding criterion. This does not necessarily provide insights into the nature of the causal mechanisms that contribute to the outcome, because it is possible to get the right answers for the wrong reasons. Finally, while Nowotny et al. concede that Mode-1 science (that is, the disciplines) continues to have a role, they present a sustained argument against it in the academy as well as in research, and so run the risk of undermining the conditions that make knowledge creatio possible. Mode 1 and Mode 2 knowledge creation need to be held in creative tension, and the latter rests upon negotiation with the former.

Implications for Universities, Higher Education, Students and Curriculum

Universities have historically been sites of knowledge creation for applied as well as pure disciplines. Identifying universities just with the pure disciplines is too narrow a conception of their role. The University of Bologna (founded c 1088

was established as a law school, while Oxford (c 1167) and Cambridge (c 1209) were established as theology schools to train graduates for the church (Grendler 2002; Leader 1988). For example, Verger (1992, p. 42) explains:

> But the fact remains that no recognized medieval university was ever restricted to arts schools. Although the latter were, in various forms, fairly plentiful in the medieval West (above all, from the fourteenth century on), they were only granted university status when they were associated with, at the very least, a faculty of theology, law, or medicine.

The pure and applied disciplines have struggled for ascendency at different times over the last 800 years, and the debate on Mode 1 and Mode 2 knowledge may be understood as another expression of this debate. Both forms of knowledge are required, and both require institutional forms and structures to support, develop, codify, curate and transmit knowledge. The pure disciplines rely almost exclusively on universities or other public research institutes. The applied disciplines are more varied. The 'old' (and elite) applied disciplines such as theology, medicine and law have had strong links with the academy and institutions and professional associations in their field of practice. These links are more tenuous in many of the newer applied disciplines (such as management and hospitality) which either have not been in the academy for very long, and/or have very weak institutions or professional associations (Bernstein 2000). Leaving the development of new forms of knowledge to the vicissitudes of the market will not necessarily result in robust forms knowledge. For example, hospitality has been in the market at least since Mary tried to find an inin which she could give birth to Christ, but it is only now emerging as a field of practice underpinned by an emergent disciplinary form of knowledge in the academy. Arguably, the development of hospitality as an applied discipline that can inform the field of practice relies on its further development in the academy, but also and inescapably, on developing institutional and professional forms of support within the field of practice.

The pure and applied disciplines have proliferated over the last 200 years as a result of the increasingly complexity of society and division of labour (Bernstein 2000). Proponents of the negation of the disciplines have a model of disciplines that is rigid and based on impermeable boundaries. But the boundaries are more permeable than this and the disciplines change in response to further engagement with their objects and with each other and society more broadly. New challenges do arise because of the pace of change and growth in complexity in society, and this poses challenges for interdisciplinary work in particular. However, rather than negating the importance of disciplinary boundaries, interdisciplinary work occurs through explicit negotiation of the boundaries. Bhaskar (2010, p. 5) argues that successful interdisciplinary work will require members of interdisciplinary teams who can work together effectively "in *cross-disciplinary* understanding". And, this "will necessitate a form of education and continuing socialization of the interdisciplinary research worker" (Bhaskar 2010, p. 5). However, while this may be so, arguably this cannot be at the expense of the creation of disciplinary experts. It is an argument for a more complex and nuanced division of labour and the creation of new roles.

Higher Education, Students and Curriculum

Higher education is broader than universities. While universities have an institutionalised role in creating and codifying knowledge, higher education is offered in institutions other than universities, and these institutions have a responsibility to ensure that students have access to abstract theoretical knowledge for two reasons. First, as Bernstein (2000) argues, society uses abstract disciplinary knowledge to construct its conversation about what it should be like. Abstract theoretical knowledge enables society to connect the present with the past and the future. It is the means society uses to imagine alternative futures through thinking the unthinkable and the not-yet-thought. It thus provides students with social access to this conversation and this is why access to abstract theoretical knowledge is fundamentally about distributional justice.

However, a precondition of social access is that students must have epistemic access—they must be able to enter the system of meaning so they can understand debates and controversies within it. So the second reason that students need access to disciplinary knowledge is because they provide epistemic access to the aspect of the natural and social world they study. This is not an argument for presenting the disciplines in curriculum as 'the truth' even though seeking the truth should be a normative goal for curriculum. Access to disciplinary knowledge provides students with access to criteria they need to judge and critique knowledge claims, and this is essential if they are to participate in debates and controversies in society more broadly and in their field of practice in particular. Access to the methods that the disciplines use to produce knowledge also helps students understand the provisional nature of knowledge as they gain new insights into their objects of study. This will assist students in becoming critics of knowledge and critical producers of knowledge.

Ironically, access to disciplinary systems of meaning will provide students with better access to the contextual. Unless students have access to knowledge which gives them insight into the causal mechanisms that interact at different levels in constructing the contextual, they will not be able to distinguish between features of the contextual that are necessary and intrinsic to it, and those that are contingent and accidental. Bhaskar's (1998b, p. 146) argument that "no moment ever contains its own truth, or act its own criteria of intelligibility" has important implications for pedagogy and curriculum. By focusing on the contextual students are denied access to the conditions of knowledge needed to understand the contextual. This is because the complexity contributing to the structuring of the contextual is denied, as is the means to access to the contextual by using the general to understand the particular. This has implications in particular for education for the professions, as discussed in the next section.

Implications for Professional Education

Privileging Mode 2 knowledge has potentially negative consequences for education for the professions. Instead of *counterposing* Mode 1 and Mode 2 forms of knowledge, it is more productive to examine the relations of relative autonomy and interdependence between the pure and applied disciplines. The applied

disciplines constitute the theoretical 'tool-box' that underpins practice and the applied disciplines provide the basis for education for the professions (Barnett 2006). The applied disciplines have emerged from processes recontextualisation from their disciplinary origins for the purposes application in fields of practice (Young 2006). However, the applied disciplines have developed relative autonomy from the pure disciplines. There is an iterative relationship between the development of the 'pure' and 'applied' academic disciplinary knowledge as each develops through their own insights and insights provided by the other. However, each has different concerns: the focus of the pure disciplines is to extend disciplinary knowledge and understanding, whereas the focus of the applied disciplines is to extend the knowledge base of practice (Young 2006).

This has important implications for education for the professions. While curriculum must have as its focus the field of practice students are being prepared to enter, the condition for their *epistemic* access is through understanding the boundaries that distinguish the pure disciplines relevant to their field, their objects of study, and the way in they are 'assembled' and translated through the applied disciplines. This provides students with access to the complexity that structures their field and the emergent relations that result from the operation of causal mechanisms in open systems. While problem-based learning models of curriculum may have a role, exclusively basing education for the professions on experiential and/or problem-based models of learning that have as their object a feature of the world and not the structures of the knowledge, may well deny students the access they need to understand their field.

Bernstein (2000, p. 52) referred the pure academic disciplines as 'singulars' because they refer to knowledge structures that are defined, insulated and named as a single field, with its own discourse, rules, texts and speakers. In contrast, he refers to preparation for the professions as the 'regionalisation' of knowledge, and their location within the academy as 'regions'. He says that:

> Regions are constructed by recontextualising singulars into larger units which operate both in the intellectual field of disciplines and in the field of external practice. Regions are the interface between disciplines (singulars) and the technologies they make possible. (Bernstein 2000, p. 52).

Consequently, the task of curriculum in higher education for the professions is to *face both ways* to the field of practice and the field of knowledge. In many ways, constructing curriculum for professions is more complex than it is in constructing curriculum for pure academic disciplines, where the orientation is just one way, towards the structures of knowledge (Barnett 2006).

Conclusion

The academic disciplines play an irreducible role in creating knowledge in society. They identify causal mechanisms of aspects of the natural and social worlds. Knowledge is always contested because there isn't a direct correspondence between knowledge and the objects of knowledge as each has its own conditions

of existence. The production of knowledge requires communities of knowledge producers with specialised practices and shared norms and conventions that they use to produce knowledge, while the objects that they study are not dependent on these knowledge producers for their existence. Gravity does not depend on scientists for its existence and nor does social class depend on sociologists for its existence. The norms and conventions of the disciplines are not given truths, but evolve through experience and debate. The disciplines don't represent 'the truth', but they do represent our best efforts so far in getting closer to the truth.

The academic disciplines represent only one part of our investigations in the world. They cannot tell the whole picture because they are focused only on an aspect of the world. Interdisciplinary work is necessary because without it one cannot identify, let alone explore, mechanisms of co-determination in open systems (Collier 1998). While the development of pure disciplines is undertaken by universities and other specialist institutions, the development of applied disciplines requires synergistic relationships between the academy and social institutions within the field of practice. Knowledge creation in pure and applied disciplines and interdisciplinary work that focuses on particular problems or objects in the world all require institutional forms of support, and each enriches the other Dichotomies where disciplinary knowledge is cast as bad and contextualised knowledge as good undermine knowledge. This is the irony in utilitarian arguments for useful knowledge that will support markets and is to be elicited by markets—these arguments undermine the conditions for the knowledge society.

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