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Cumulative and segmented learning: exploring the role of curriculum structures in knowledge-building

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The present article extends Basil Bernstein's theorisation of 'discourses' and 'knowledge structures' to explore the potential of educational knowledge structures to enable or constrain cumulative learning, where students can transfer knowledge across contexts and build knowledge over time. It offers a means of overcoming dichotomies in Bernstein's model by conceptualising knowledge in terms of *legitimation codes* (bases of achievement) and *semantic gravity* (context-dependency of knowledge). This developed framework is used to analyse two contrasting examples of curriculum – from professional education at university and secondary school English – that aim to enable cumulative learning. Analyses of students' work products show that both cases can constrain knowledge-building by anchoring meaning within its context of acquisition. The basis for this potential is located in a mismatch between their aims of enabling students to learn higher-order principles and their curricular means that focus on knowers' dispositions rather than articulating principles of knowledge.

Keywords: Basil Bernstein; knowledge structures; legitimation code theory; authentic learning; transfer

Introduction

... one of the best benefits I have been offered by this culture and this society is the introduction to the intellectual life, to generalization and its relations to particular things. (Hoggart 2005, 65)

The issue of how to enable cumulative learning, where new knowledge builds on and integrates past knowledge, is becoming increasingly salient. Contemporary policy debates suggest that education must prepare the young for 'lifelong learning' to meet the fast-changing demands of working in a 'knowledge economy' (see Field 2006). Policy rhetoric emphasises the capacity of workers to continually build knowledge, add new skills, and give new meanings to existing abilities – a form of cumulative learning. Conversely, segmented learning – where students learn a series of ideas or skills that are strongly tied to their contexts of acquisition, problematising transfer and knowledge-building – remains a pressing concern in educational debates ranging from the humanities (Christie and Macken-Horarik 2007) to science (Tytler 2007). As recent commentators have argued, one issue often missing from

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research into this issue is the role played by the structuring of knowledge itself (Moore 2007; Young 2008).

A key contribution of Basil Bernstein's theoretical framework to the sociology of education is the foregrounding of knowledge as an object of study. In his later work, Bernstein explored intellectual fields of knowledge production, mapping their characteristics in terms of 'discourses' and 'knowledge structures' (2000, 155–174). One issue raised by this model is how knowledge changes over time, and a number of studies are drawing on his concepts to examine how intellectual and educational fields develop in different ways (for example, Maton 2000; Moore 2007; Muller 2007). The present article extends these concerns to address the development of students' knowledge over time. I aim to explore how curriculum structures play a role in creating conditions for students to experience *cumulative learning*, where their understandings integrate and subsume previous knowledge, or *segmented learning*, where new ideas or skills are accumulated alongside rather than build on past knowledge. Specifically, the principal aim is to explore the features of educational knowledge that may constrain cumulative learning.

To do so, I shall extend Bernstein's later theoretical framework in two principal ways. First, Bernstein conceptualised the production of new knowledge in intellectual fields; this article develops these ideas to address the reproduction of educational knowledge. Secondly, where Bernstein's model comprises dichotomous ideal types, the article explores the underlying principles structuring these forms of knowledge. I begin by outlining Bernstein's model and sketching the concepts of *legitimation codes* and *semantic gravity* as ways of overcoming its limitations. This framework is then used to analyse two contrasting examples of educational practice that claim to enable cumulative learning: an 'authentic learning environment' in professional education at university; and a thematic unit of study in secondary school English. Analyses of students' work products show that both these curriculum structures can constrain cumulative learning – students' understandings often struggle to reach beyond the specific context. I argue that one basis for such segmented learning lies in a mismatch between their aim of enabling students to acquire higher-order principles of knowledge and their means, which focus on knowers' dispositions rather than explicitly articulating these principles of knowledge.

Overcoming Bernstein's dichotomies: semantic gravity

In his later work, Bernstein (2000, 155–174) outlines a way of conceptualising different structurings of knowledge. He distinguishes, first, between forms of 'discourse'. *Horizontal discourse* refers to everyday or 'commonsense' knowledge and 'entails a set of strategies which are local, segmentally organised, context specific and dependent' (2000, 157). The knowledges comprising this discourse are characterised by 'functional relations of segments or contexts to the everyday life' (2000, 158–159); that is, meaning is dependent on its social context, so knowledge acquired in one context does not necessarily have meaning or relevance in other contexts. In contrast, *vertical discourse* refers to 'specialised symbolic structures of explicit knowledge' (2000, 160), or scholarly, professional and educational knowledge, and 'takes the form of a coherent, explicit, and systematically principled structure' (2000, 157). Here meaning is less dependent on relevance to its context, and instead is related to other meanings hierarchically. Bernstein then distinguishes within vertical discourse between 'hierarchical' and 'horizontal' knowledge structures. A hierarchical knowledge structure, illustrated by the

sciences, is a ‘coherent, explicit and systematically principled structure, hierarchically organised’, which ‘attempts to create very general propositions and theories, which integrate knowledge at lower levels’ and cover the maximum number of empirical phenomena with the smallest number of axioms (2000, 160). In contrast, a horizontal knowledge structure, illustrated by the humanities and social sciences, is ‘a series of specialised languages with specialised modes of interrogation and criteria for the construction and circulation of texts’ (2000, 161).

One issue this model highlights is the way knowledge develops over time. Hierarchical knowledge structures develop through new knowledge integrating and subsuming previous knowledge, whereas horizontal knowledge structures develop through adding on another segmented approach or topic area. We thus have integration and subsumption of knowledge in one form, and accumulation and segmentation of knowledges in the other. In outlining these concepts, Bernstein’s focus was the production of *new* knowledge in intellectual fields. Although touching briefly on such issues, his model does not address how these forms of development might be realised within a curriculum or students’ learning experiences. To explore these issues one can, by extension, distinguish between *hierarchical* and *horizontal curriculum structures* according to whether a unit of study (lesson, module, year, etc.) builds upon the knowledge imparted in previous units through integration and subsumption or through segmental aggregation. Similarly, one can distinguish the ways in which students’ understandings develop over time (as evidenced by, for example, their work products), according to whether they build on their previously learned knowledge, and take that understanding forward into future contexts or learn knowledge that is strongly bounded from other knowledges and contexts. This is to distinguish between what can be termed *cumulative learning*, where students are able to transfer knowledge across contexts and through time, and *segmented learning*, where such transfer is inhibited.¹

My principal focus in this article is to explore from within this general approach the features of curriculum structures that may constrain cumulative learning. However, to do so requires conceptual development. Bernstein’s mapping of knowledges can be criticised for offering dichotomous ideal types whose differences are too strongly drawn. It raises questions of whether all horizontal discourse is the same, whether there are quantum shifts between the two forms of discourse and between the two forms of knowledge structures, and where particular disciplines and curricula fit within the model. The concepts also highlight what *kind* of discourse or knowledge structure one might discover in research, but not what makes a discourse ‘horizontal’ or ‘vertical’ or a knowledge structure ‘hierarchical’ or ‘horizontal’. As Muller argues, Bernstein’s concepts remain ‘locked into an early (lexical) metaphorical stage of discussion, where the terms are more suggestive than they are explanatory’ (2007, 65). To overcome these dichotomies necessitates developing the framework to theorise the underlying principles generating discourses, knowledge structures, curriculum structures and forms of learning.

One such development can be found in Legitimation Code Theory, which builds on the insights of Bernstein, among others (Maton 2000, 2006, 2007; Moore and Maton 2001). This approach views the practices and beliefs of actors as embodying competing claims to legitimacy, or messages as to what should be considered the dominant basis of achievement within a social field of practice. These ‘languages of legitimation’ are analysed in terms of their underlying structuring principles or ‘legitimation codes’. One such code is ‘specialisation’, or what makes someone or something different, special and worthy of distinction. Put very briefly, discursive practices

are analysed according to whether they emphasise as the basis of legitimate insight the possession of explicit principles, skills and procedures (knowledge code), attitudes, aptitudes and dispositions (knower code), both specialist knowledge and knower dispositions equally (elite code), or neither (relativist code). These codes help excavate the underlying principles generating forms of knowledge; for example, hierarchical knowledge structures are underpinned by knowledge codes, and horizontal knowledge structures are typically generated by knower codes (Maton 2007; Moore 2007; Muller 2007). They are also being used to explore a range of issues in empirical studies of education (for example, Carvalho, Dong, and Maton 2009; Doherty 2008; Lamont and Maton 2008). I shall draw on these ideas in this paper. However, while shedding light on the bases of knowledge-building (Maton 2000, 2008), they do not directly conceptualise the contextual transfer of knowledge.

Bernstein's model provides a clue as to how to address this issue. A key feature of his mapping concerns relations between knowledge and its social and cultural contexts. One can thus describe forms of knowledge in terms of the degree to which meaning is dependent on its context, or what I shall term *semantic gravity*. Semantic gravity may be relatively stronger or weaker. When semantic gravity is stronger, meaning is more closely related to its context of acquisition or use; when it is weaker, meaning is less dependent on its context. Different discourses and knowledge structures (as well as curriculum structures and forms of learning) can then be recast in a less dichotomous fashion as representing points on a continuum; that is, as realisations of different degrees of semantic gravity (see Figure 1). Vertical discourse can be described as characterised by weaker semantic gravity than horizontal discourse. Within vertical discourse, hierarchical knowledge structures exhibit weaker semantic gravity than horizontal knowledge structures. Finally, cumulative learning depends on weaker semantic gravity and segmented learning is characterised by stronger semantic gravity constraining the transfer of meaning between contexts. Thus, one condition for building knowledge or understanding over time may be weaker semantic gravity.

I shall now use this framework of 'semantic gravity' and 'legitimation codes of specialisation' to explore how the structuring of educational knowledge may constrain cumulative learning (and enable segmented learning). This analysis will in itself embody my emphasis on providing meanings that are able to overcome the semantic

Semantic gravity		Forms of:		
		<u>discourse</u>	<u>knowledge structures or curriculum structures</u>	<u>learning</u>
weaker	↑ ↓	vertical	hierarchical	cumulative
			horizontal	segmented
stronger		horizontal		

Figure 1. Semantic gravity and structurings of knowledge.

Note: Vertical lines highlight that specific forms of knowledge and learning are not necessarily associated (e.g. a hierarchical curriculum structure does not by itself enable cumulative learning).

gravity of specific contexts. It does so through using the same concepts to examine two different examples of educational practices from contrasting institutional and disciplinary contexts: ‘authentic learning’ in professional education at university, and a unit of study entitled ‘The Journey’ in secondary school English. Both curricular practices are said by their proponents to enable students to transfer knowledge across contexts and build their understandings over time.

‘Authentic learning’ in professional education

In recent years, professional education has been increasingly influenced by ‘authentic or ‘situated’ learning. Proponents claim that, to enable students to transfer their knowledge to contexts beyond education, they require learning tasks that reflect the realities of practices in those everyday contexts and that allow them access to the knowledge of experts with experience of relevant real-world practices (for example, Brown, Collins, and Duguid 1989; Herrington and Oliver 2000). Authentic learning is thus often associated with problem-based, case-based and project-based pedagogies offering students real-life examples of the working practices of, for example, designers or journalists (Bennett, Harper, and Hedberg 2002). Such ‘authentic learning environments’ are said to create learning experiences that help build on students’ prior experience and take their knowledge into the future world of work (Herrington et al. 2004); that is, they are claimed to enable cumulative learning.

To analyse an example of this approach, I draw here on a major study conducted by Bennett (2002) at the University of Wollongong, Australia. Bennett investigated a postgraduate master’s degree course for training instructional designers (professionals who design learning resources). One aspect of this study explores a task using ‘case-based learning’ and designed according to authentic learning principles. The unit of study required students to analyse two case studies of real-life instructional design projects, each case comprising approximately 15,000 words of unedited transcripts of interviews with three people who had worked on each project. Students had to answer a series of questions designed to encourage them to think beyond the context of the cases (Table 1).

Table 1. Task questions.

-
1. Describe the major stages and decision points in the process of developing the product. What are the major issues at each stage?
 2. How do the experiences of the designers in this case relate to:
 - 2a. other *literature you have read* about multimedia design and development or
 - 2b. *your own experiences as a designer* (for example in your work or for EDGI913 [an earlier subject in the course])?
 3. Choose a particular feature of the product which is discussed in the case.
 - 3a. Describe *how you think* it relates to the original concept and goals of the project.
 - 3b. From the information in the case *what do you think* were the major design issues in developing this feature?
 - 3c. *Do you think* the feature is effective? Explain your reasoning.
 4. What are the major project management issues in developing a multimedia CD-ROM that are highlighted by this case? (Use example situations from the case to support your ideas.)
 5. What are the main things that *you think you learnt* from studying this case?
-

Source: Bennett (2002, 75–76; emphases added).

Three features of this task are salient for the current analysis. First, the questions ask students to bring in knowledge from beyond the cases, such as other literature they have read or their own experiences (e.g. Question 2 in Table 1). Secondly, they ask for progressively more generalisation and abstraction: they begin by asking students to describe key issues in the cases, and end by focusing on general issues about what they have learned. The aim is thus to help weaken semantic gravity by encouraging students to make meanings that go beyond the learning context. They are asked to think in terms of both other similar contexts and less context-dependent ideas transferable into possible future contexts.

Thirdly, the task embodies a knower code by emphasising dispositions of knowers as the basis of legitimate insight and backgrounding specialised skills and procedures. Proponents of authentic learning often *espouse* the need for reflection, articulation of tacit knowledge and active scaffolding by teachers, but *enacted* environments described as ‘authentic’ often neglect these features and downplay direct instruction (for example, Herrington and Oliver 2000). In line with such enacted authentic learning environments, classroom interaction between staff and students in this unit of study focused on explaining the nature of the task but did not involve explicitly teaching the procedures of instructional design or the principles for bringing such procedures to bear on the contexts being studied. Specialised explicit knowledge was thus downplayed. Instead, students were expected to put themselves ‘into the shoes’ of the interviewed professionals – a focus on the dispositions of knowers. The basis of achievement at the task was also characterised by a knower code: questions focus on eliciting students’ personal perceptions, beliefs and experiences (‘what you think’; ‘your own experiences’) rather than relating the cases to explicit principles of instructional design (see emphases in Table 1).

Analysing responses

To explore how this authentic learning environment helped shape students’ understandings, their work products were coded using a language of description (Bernstein 2000) or a means of translating between empirical data and theoretical concepts (see Table 2). From left to right, the columns in Table 2 outline: relative strengths of semantic gravity; the coding scheme used to analyse students’ work products; a description of each coding; and an example drawn from student answers. ‘Reproductive description’ (e.g. direct quotation from the cases) embodies the strongest semantic gravity – meanings are locked into the context of the case from which the quote is taken. ‘Abstraction’ embodies the weakest semantic gravity: meanings are decontextualised from the specific case to create abstract principles for use in other potential contexts. The coding scheme was adapted from Allen’s (1995) use of frameworks for classifying reflective writing, originally developed by Hatton and Smith (1995) and Sparks-Langer et al. (1990).

Student answers were broken down into individual ‘units of meaning’ (passages conveying a single coherent meaning) and each unit was coded using the scheme. The study comprised 12 students whose work products comprised 1700 units of meaning in total. The analysis shows that relatively little of the students’ work products (as a percentage of the whole) comprise ‘reproductive description’ or unmediated quotation (see Figure 2). This is unsurprising because the students were postgraduates and the unedited interview transcripts did not lend themselves to extensive quotation. However, around one-third of the total units of meaning in students’ work comprise

Table 2. A language of description for semantic gravity.

Semantic gravity	Coding of response	Form taken by student response	Example quote from student answers
weaker ▲ ↓ stronger	Abstraction	Presents a general principle or procedure that moves beyond the cases to address wider or future practice.	'Legal and intellectual property issues are a major consideration when developing a product.'
	Generalisation	Presents a general observation or draws a generalising conclusion about issues and events <i>in</i> the case.	'Precious time would be wasted and deadlines not met when members did not have a full concept of the project.'
	Judgement	Goes beyond re-presenting or interpreting information to offer a value judgement or claim.	'While each metaphor provides a realistic learning environment ... I felt that the <i>Nardoo</i> metaphor assists with navigation, while the <i>StageStruck</i> metaphor was a barrier to effective navigation.'
	Interpretation	Seeks to explain a statement by interpreting information from the case or adding new information. May include use of other literature or personal experience.	'While not alluded to in the interviews, this may have caused problems for the team, as there would have been a new software to work with, and transferral of information from <i>Hypercard</i> to <i>MediaPlant</i> .'
	Summarising description	Descriptive response that summarises or synthesises information presented in the case, including re-wording and re-structuring of a number of events into one statement. Does not present new information from beyond the case.	'This involved creating the overall structure and content of the project, with design briefs and statements being forwarded to the client, with the final design statement being signed off by the client, giving a stable starting position for the project.'
	Reproductive description	Reproduces information directly from the case with no elaboration (i.e. quotations).	'The NSW Department of Land and Water Conservation (DLWC) approached the Interactive Multimedia Learning Laboratory (IMMLL) at the University of Wollongong to develop an educational multimedia package.'

'summarising description', and just over one-half are 'interpretation'. Relatively less of the work products comprise 'judgement', 'generalisation' or 'abstraction'. So, the majority of work produced by students in this group is characterised by relatively higher semantic gravity. Meanings are mostly strongly related to the context of the cases being studied, as shown by the very low number of instances in which students make judgements and draw generalisations. This is *despite* the task involving questions requiring students to think beyond the specific cases being studied.

One might not expect a high percentage of students' responses to embody weaker semantic gravity, because otherwise their work would be overly abstract and disconnected from the learning materials. However, comparing the responses of individual

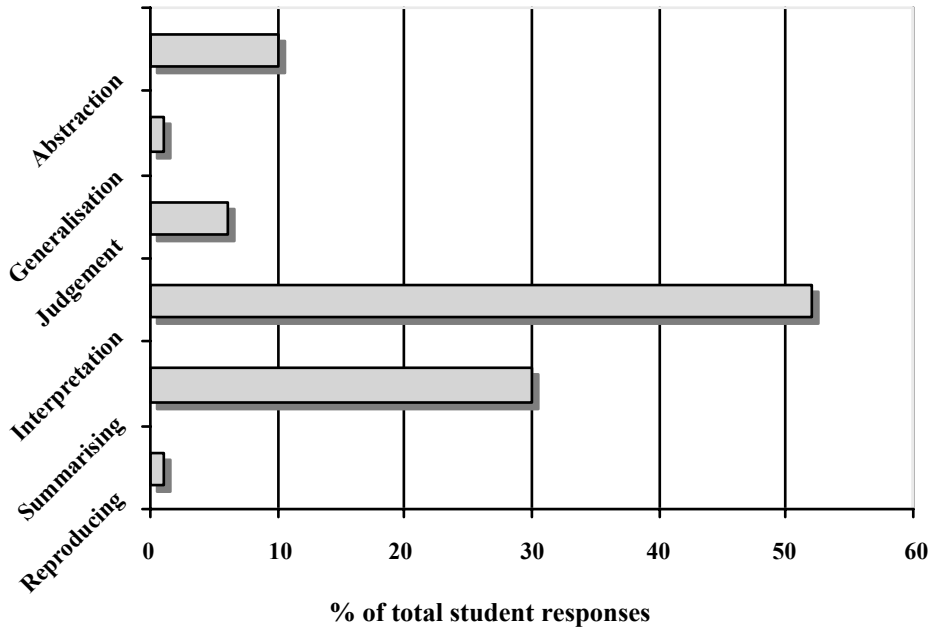


Figure 2. Total of all student responses (units of meaning).

students makes it clear that some are more able than others to overcome the semantic gravity of the cases.² Figure 3, for example, compares the responses of two pseudonymised students. Overall, Joanne's answers are grouped further down and exhibit stronger semantic gravity; they are more weighed down in the context of the cases than those of Steve. This difference is also shown by instances in which students'

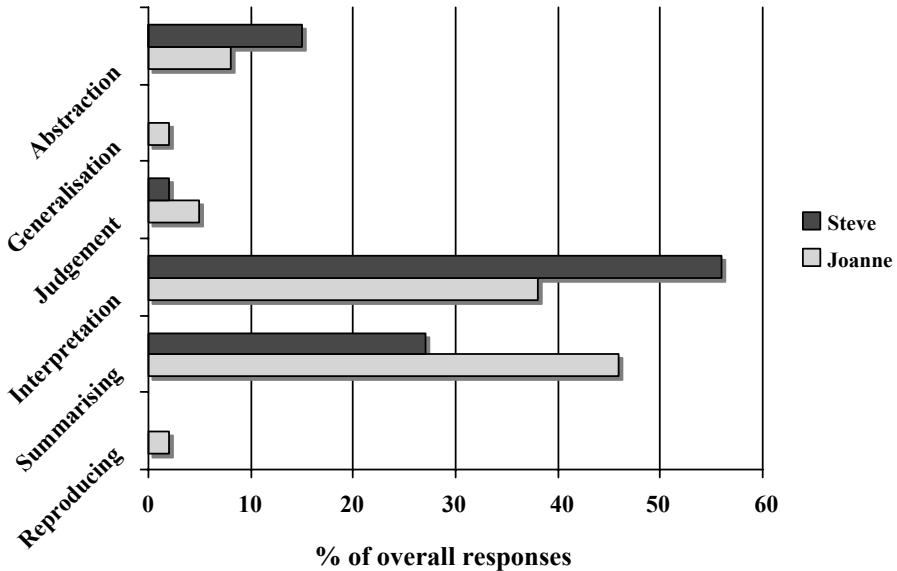


Figure 3. Responses of two individual students.

work moved beyond reproductive or summarising description. For example, when Liz draws conclusions they remain grounded within the context of the cases – such as:

Tasks and responsibilities often remain unclarified in this ‘design’ phase (Phillips & Jenkins 1998). The reflections of Rob Wright ... seem to reflect on a type of ‘juggling act’ between responsibilities with instructional design issues and scheduling a project of this magnitude. (Bennett 2002, 129)

In this example Liz uses other literature to generalise about the design phase of the project, but her conclusions remain located within the context of the studied cases (the experiences of Rob Wright, one of the designers) rather than developing principles for application to other possible projects. In contrast, when Ian draws conclusions about the cases, he goes further to offer more abstracted principles, including:

... a list of ideas that one might keep in mind when designing and producing a multimedia project. The issues examined in the two case studies sparked these ideas. Here are those ideas, listed in no particular order.

- Set priorities in your product development. Know what you must have and what aspects of the project are not vital.
- At some point, you must become precise in what features and content you want in your design. Working in generalities does not allow you to proceed effectively in the final stages of the project.
- Start small and build your project from there. By doing this you will not have to be cutting material all the time ... (Bennett 2002, 147)

Ian thereby uses the cases as a launch pad from which to offer knowledge that can be taken into other possible design contexts. Thus, while some students’ expressed understandings included ‘abstraction’, most remain immersed in the pedagogic context.

While proponents of authentic learning environments claim they enable students to acquire knowledge useable beyond the specific learning context, this example (and the larger study from which this is drawn) suggests they do not necessarily enable cumulative learning. The unit of study analysed here resulted in many students’ understandings remaining rooted in the context: stronger semantic gravity. One feature characterising the unit is a knower code. Drawing on constructivist ideas that emphasise the learner’s role in constructing their own understandings of practice, such authentic learning environments typically emphasise students drawing on personal experience and imagining themselves within the case being studied, and downplay the role of direct instruction about the procedures to be used or the principles of knowledge to be learned. This grounds knowledge more firmly within a context, constraining the potential for many students to achieve cumulative learning. Importantly, it may also set up many students to underachieve as it is the ability to generalise and abstract that is rewarded in such tasks. The aim of authentic learning environments is to enable students to derive higher-order principles, but the knower code often characterising such environments means that students will often succeed only if they already possess those principles.

‘The Journey’ in secondary school English

School English has often been the focus of debates over fragmentation of the curriculum (Christie and Macken-Horarik 2007). A recent example of an English curriculum designed to enable cumulative learning is ‘The Journey’, a unit that is compulsory for

all students taking the Higher School Certificate in New South Wales, Australia. The unit requires students to explore the concept of ‘the journey’, which can be ‘physical’, ‘imaginative’ or ‘inner’ journeys. These three are similarly structured; here I focus on ‘Imaginative Journeys’, which involves texts that ‘take us into worlds of imagination, speculation and inspiration’ (Board of Studies New South Wales [BoS] 2006a, 10).³ In 2005, students were set the question:

To what extent has studying the concept of imaginative journeys expanded your understanding of yourself, of individuals and of the world?

In your answer, refer to your prescribed text, ONE text from the prescribed stimulus booklet, *Journeys*, and at least ONE other related text of your own choosing. (BoS 2006b, 11)

The ‘stimulus booklet’ comprises two poems, short extracts from three books, and a bookcover; the prescribed list of texts includes a work of fiction, a selection of poems, Shakespeare’s *The Tempest*, a popular history of science, and the film *Contact*.

‘The Journey’ syllabus is characterised by attempts to weaken the semantic gravity of students’ understandings by reaching beyond particular texts to embrace more abstract principles of literary understanding. For example, the syllabus claims that students will learn how to ‘explore and examine *relationships* between language and text, and *interrelationships* among texts’ and how to ‘*synthesise* ideas to clarify meaning and *develop new meanings*’ (BoS 2006a, 9; emphases added). It thus expects students’ understandings to exhibit a relatively high level of abstraction centred on the idea of ‘The Journey’, rather than on a particular text, literary genre or theory. The unit of study also includes texts from beyond the traditional literary canons (such as a film) and requires students to apply their knowledge beyond the curriculum by choosing at least one text of their own. The unit thereby aims at enabling students to learn knowledge they can take into encounters with new texts – cumulative learning.

Although located in a different institutional setting and region of the disciplinary map to the first case study, ‘The Journey’ shares similar features in the means used to enable cumulative learning. The unit represents a knower code in its focus on students as knowers rather than on explicitly imparting specialised knowledge, skills or procedures. For example, the syllabus asks for ‘your understanding of yourself, of individuals and of the world’ and expects students to empathise with texts (see Christie and Humphrey 2008). There is little explicit guidance in curriculum documents as to how to select or integrate texts around the idea of ‘The Journey’, or indeed what this idea means. Instead, the syllabus incorporates modelling of best practice. It includes a book of *Student Answers* (BoS 2006b) comprising examples of essays rated as achieving medium and high grades, and examiners’ comments after each essay. These comments, however, are brief and often vague. For example, highly rated essays are typically described as a ‘sophisticated discussion’, ‘insightful’ and ‘a very sophisticated and purposeful response’ (BoS 2006b, 114), or ‘complex’ with a ‘judicious selection of texts’, and ‘tightly written and strongly focused’ (2006b, 101). Examiners’ comments on medium-grade essays are usually slightly longer but remain confined to stating, for example, that less description and more ‘analysis and evaluation’ are required (2006b, 127), without explicating what this analysis and evaluation might comprise.

Analysing essays

Ongoing collaborative research is analysing the unit in terms of its syllabus, classroom pedagogies and students' work products. To illustrate the latter, I shall compare two examples. The first is a low-achieving essay typical of a significant proportion of students' work.⁴ As a whole, the essay has a segmented form – it discusses one text at a time, with each text strongly bounded from the others. Even when bringing texts together, the student keeps them apart; for example, the essay concludes 'I took three wonderful journeys' rather than one journey that embraced three texts. Discussion of each text is also very concrete and related to real life. For example, when discussing the novel *Ender's Game*, the student proclaims:

I found I could relate to Ender in many ways and I didn't stop to think that this story wasn't actually real, because when reading, I was so involved that I truly thought that what was happening around Ender and I was reality.

The essay is thus a highly personal and subjective response. It is the student's personal experiences that serve as the basis for selecting, recontextualising, and evaluating texts – for example:

I felt very empathetic towards the character Ender. I found myself involved in the novel, travelling my Imaginative journey alongside Ender. I felt that Ender was a friend of my own

In short, meanings are strongly related to their contexts and based on a knower code – the student as knower is central, rather than any specifically literary knowledge.

An essay offered in official syllabus documents as an example of success represents a striking contrast (BoS 2006b, 102–114). The essay begins and ends by bringing its chosen texts together in relation to an overarching principle – for example:

The journey, especially in the imaginative sense, is a process by which the traveller encounters a series of challenges, tangents and serendipitous discoveries to arrive finally, at a destination and/or transformation. (BoS 2006b, 102)

The student then discusses each text in turn but by moving between concrete examples and abstract ideas. The essay thereby embodies a process of weakening and strengthening semantic gravity; for example, when discussing *On Giants' Shoulders* by Melvyn Bragg:

In portraying their [scientists'] separate profiles as one story in a chronological line up, Bragg delineates the concept of a cumulative and ongoing journey, reflected in his thesis that science is 'an extended kind of continuous investigation'. (BoS 2006b, 103)

Rather than relating the texts solely to empirical reality, meanings are constructed in a less subjective and personal manner, so that even when discussing himself/herself, the student relates their experiences to abstracted principles – for example:

I personally have learned the importance of individuals interlinking with others to achieve a greater end, and influencing or inspiring others, as inherent in the concept of scientists standing on 'giants' shoulders'. (BoS 2006b, 103)

In summary, it is as if meaning in the first essay is weighed down by the gravity of each text discussed: the student cannot see beyond a text, and addresses only one

text at a time, usually in direct relation to his/her own experiences, feelings and beliefs. This is a highly segmented form of writing, where the basis of selection, recontextualisation and evaluation is the student as knower. In contrast, it is as if meaning in the second essay enjoys far lighter gravity: the student is able to leap up further from the concrete base of each text or his/her own experiences to reach more abstract principles with which different texts can be related together (weakening semantic gravity) before then returning to another, different concrete context (strengthening semantic gravity). For example, when the student's own understandings and experiences are brought into the essay, they are then objectified and abstracted.

This example highlights that many students may be unable to recognise or put into practice what they need to succeed at this compulsory unit of study. Analysis of high-grade essays reveals that achievement is measured in terms of students using abstract principles (knowledge code) to integrate meanings from different texts (weaker semantic gravity). This is also what the syllabus claims to enable. However, as the low-achieving essay suggests, it is easy for students to read the assessment question as requiring a subjective description of one's personal preferences, and little guidance is offered in curriculum documents as to what the abstract concept of 'The Imaginative Journey' means or how it should be used to analyse texts. This knower code is reflected in low-achieving essays characterised by stronger semantic gravity. Thus, many students may not only experience segmented learning but also may fail to gain high grades.

Conclusion

I began this paper by highlighting contemporary policy and educational concerns with enabling students to experience cumulative learning. Both of the curriculum structures discussed here are intended to provide such learning experiences. Both proclaim students will learn higher-order principles (an emphasis on knowledge, skills and procedures, or knowledge code) capable of application in new contexts (weaker semantic gravity). However, both offer minimal explicit guidance on these principles, focusing instead on students' dispositions (knower code), and both often result in students' understandings remaining rooted in the context of the unit (stronger semantic gravity). One feature of educational knowledge that may constrain cumulative learning is, I suggest, this code mismatch: the attempt to achieve knowledge code outcomes using knower code means.

A focus on students' dispositions, aptitudes and attitudes is, however, not in itself the problem. Knower code educational practices can enable what psychologists term 'low-road transfer', the automatic triggering of well-learned behaviour in a new context (Salomon and Perkins 1989). For example, in craft knowledge, tacit pedagogy within a master-apprentice relationship works at shaping the dispositions of learners so that they can integrate and subsume past ways of acting and being (Gamble 2001). Knower code means can thereby help to enable knower code outcomes, providing conditions for a form of cumulative learning focused on students' habituses rather than explicitly articulated procedures.

In contrast, the curriculum structures discussed here aim to enable 'high-road transfer', the mindful abstraction of meaning from one context and its application within another context (Salomon and Perkins 1989). As the model English essay illustrates, this is also the basis of assessment: the capacity to demonstrably move between concrete cases and abstract ideas. Such high-road transfer requires principles

for recontextualising knowledge so that meaning can overcome the gravity well of specific contexts (Bernstein 2000, 160; Wheelahan 2007). However, the two units downplay explicit guidance as to these principles and instead focus on learners' dispositions as knowers. This mismatch between educational means and ends, I suggest, can constrain the potential for students' knowledge to achieve weaker semantic gravity and so enable the kind of transfer required for cumulative learning. It is a matter of horses for courses, or codes for roads: knowledge codes can enable high-road transfer; knower codes can (over an extended period) enable low-road transfer.⁵

The problem of segmented learning is, of course, not new in education. However, the concepts of legitimation codes and semantic gravity provide a fresh and potentially useful framework for addressing this issue. Theoretically, they develop Bernstein's model in two ways: first, by reconceptualising forms of discourse, knowledge structure, curriculum structure and learning on a continuum rather than as dichotomous ideal types; and, secondly, by exploring the principles generating these different forms. They also provide a basis for researching cumulative learning that highlights the often neglected issue of the structuring of knowledge. For social realist approaches to education, knowledge has its own causal powers and tendencies. That is, different structurings of knowledge possess different affordances – they lend themselves more to certain forms of pedagogy, evaluation, identity, change over time, and so forth, than others. This article addressed two such features of knowledge – underlying measures of achievement and content-dependency – and began exploring their potential for enabling or constraining cumulative learning.

This focus on the structuring of knowledge is obviously only part of the picture. As illustrated here, not all students' work products exhibit the same form of learning – this depends on more than just the structuring of educational knowledge. A fuller understanding of cumulative learning requires researching, *inter alia*, the roles played by different forms of pedagogic practice and classroom interaction, as well as the different orientations to meaning students bring with them to education. It would also require tracing the development of students' understandings over longer periods of time. This reaches beyond the scope of the present article, although Bennett's (2002) study includes such research, and ongoing collaborative studies of school subjects including English will address classroom practices. Nonetheless, to explore the role of knowledge structures in education is not to fetishise knowledge; it is intended to complement rather than displace other analyses. Moreover, one advantage of the theoretical framework used here is that concepts are not locked into specific contexts of application and so disparate foci such as curriculum guidelines, pedagogy and student work products can be integrated. The approach thereby itself enables the weakening and strengthening of semantic gravity across different contexts required for cumulative knowledge-building (Maton 2008). Such a fully-rounded and integrative picture of cumulative learning is crucial if we wish more students to enjoy, as Richard Hoggart put it, one of the best benefits society offers: an introduction to the intellectual life, to generalisation and its relations to particular things.

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Notes

1. Bernstein uses the term ‘segmental pedagogy’ to describe the acquisition of horizontal discourse, and distinguishes this from the ‘institutional pedagogy’ of vertical discourse (2000, 159). In contrast, cumulative and segmented learning may refer to the acquisition of *either* form of discourse – these concepts represent a necessary development for overcoming Bernstein’s dichotomies (see below, main text).
2. The gendered nature of examples here is coincidental. The study showed no discernible gender differences.
3. This discussion builds on ongoing research with Frances Christie and Mary Macken-Horarik; see also Christie and Macken-Horarik (2007) and Christie and Humphrey (2008).
4. This essay was collected as part of a major study funded by the Australian Research Council into ‘Key Indicators of Writing Development’, undertaken during 2004–2006. I am grateful to the Chief Investigators, Frances Christie and Beverley Derewianka, for permission to quote from it here.
5. Both units involved modelling (design project case studies or model student essays) that can enable low-road transfer, but such dispositional knowledge-building requires encounters with a greater range of different context-situations and over longer periods of time (Salomon and Perkins 1989).

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