

When the lights flash: The imaginative function in student science (0178)

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Abstract

This paper combines comparative analysis of learning theory with case study data from third year bioscience. The work illustrates the ways that cognitive and dialogic 'positions' construe learning differently and specifically focuses on the function of imagination.

The data illustrate the different ways that insight occurs in dialogue: first because of shifts from one mode of representation to another (moving from writing to drawing, for example); second in more conspicuously inter-textual readings as multiple texts and text-types are read in their relations. To paraphrase one student; *"My own position seems to appear for itself - as I try to imagine how a lecture or paper might be read from the perspectives of another person - a different teacher or another scientific author"*. The analysis includes development of Bruner's theories of 'paradigmatic' versus 'literary' ways of knowing and the discussion develops theories of self-authorship. Some of the implications for teaching university science are discussed.

Outline

Whilst essentially cognitive and dialectical theories of concept learning (like Vygotsky's notion of learning in the ZOPED) have had considerable impact on science teaching, there is also growing acknowledgement that literary theory is relevant to science education because of pointing at the ways that understanding arises in language use. Michael Bakhtin's dialogic theory of language in particular, provides a systematic account of imagination, explaining how insight arises because of being able to imagine how a subject might look from the perspectives of another person. This is also an account of understanding as a process; but different from Vygotsky's work, dialogism does not view language as a tool for bringing about cognitive change, it is a theory of interpersonal relations occurring in language *per se*. Acknowledging this leads to some very different implications for teaching in science and it provides a different theoretical frame for exploring the student learning experience. The purpose of this paper is the development of dialogic theory for analysis of teaching and learning in university bioscience. The work includes some detailed case studies that illustrate the imaginative function in student learning. This case study data comprises more than 60 hours of interviewing carried out in the course of third years study, revision and examination. The paper will be illustrated using video clips from these interviews showing students going about their study work as well as offering their own commentary on their learning process.

For its theoretical development, this paper will also review recent work on the academic literacy of science drawing attention to the ways that understanding science arises in its language practice. But I will attempt to highlight in particular, the special problems of science education that are consequence of disjuncture between the two poles of science language (i.e. the discontinuity that

exists between the language *system* of science and the *events* of science language practice). For other disciplines, the two poles of language are related in continuum. In the social sciences, for example, the language system itself is developed for thinking about the thoughts of others - so that discourse in social science is always dialogic and has potential to engender insights leading to understanding. By contrast, the language system of science is a monologue, having no potential for *understanding* and making scientific language synonymous with the knowledge structures that are known to science. Science education therefore faces a division between learning and teaching the language of science (that is also equivalent to learning scientific 'fact') and a different (social or inter-personal) process of science practice learning. While the former leads to scientific knowledge, it is only the latter that can turn this knowing into understanding – give it utility and lead to people becoming scientists (or at least being able to read science critically and distinguish between what is good science and what is not). Put another way, where other disciplines can teach a single subject, science teaching must effectively address two different subjects: the one that includes the language system only (or the 'facts' of science); and the other that is about the process of *doing* (reading, discussing, experimenting) science. And it therefore inter-personal

These issues make learning for understanding particularly difficult for science students. Perhaps most importantly, (role) models of the science 'reading' process are hard to come by when the traces of the imaginative process by which scientists *do* research is effectively purged from their published work before it becomes part of the authorised language/knowledge system. But as the case study data will show it is precisely the imaginative function that is needed by students if they are to succeed in their science learning.

The situation is made yet more complex by the variety of representational modes that are used in science. Scientific literacy includes many different forms of graphic image (some of which have very different logic and grammar) as well as statistical literacy and numeracy and of course the written and spoken word. Perhaps surprisingly, however, the very difficulty of this wide repertoire of modal forms helps to mitigate the problem of disjuncture from science language system. It is precisely because what can be said in drawing (for example) is quite different from what is it possible to say in words that shifting from one mode to another requires imagination and can engender understanding. A process Kress (2003) refers to as transduction. Once more the cases described in this paper will give examples of transduction function and begin to suggest ways in which science curriculum can be developed to focus more on science literacy and the *understanding* that this fosters. Thus in my conclusions I will try to show how drawing on literary theory is essential for enhancing the quality of university science teaching and a number of practical teaching interventions will be suggested.

Kress, G., 2003. *Literacy in the New Media Age*. Routledge: London & New York.