

# MEANING MAKING IN HIGH SCHOOL SCIENCE CLASSROOMS: A FRAMEWORK FOR ANALYSING MEANING MAKING INTERACTIONS

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## ABSTRACT

In this paper, we introduce and exemplify aspects of a tool for analysing the various forms and functions of discursive interactions in high school science classrooms. This tool, or analytical framework, is based on a sociocultural view of teaching and learning, and consists of five linked aspects: *Teaching purposes*; *Content of the classroom interactions*; *Communicative approach*; *Patterns of discourse*; *Teacher interventions*. Here we focus attention on introducing and exemplifying how different teaching purposes can be addressed through combinations of communicative approach and patterns of discourse, as the scientific 'story' develops. In this way we demonstrate how the different aspects of the framework interrelate, providing a coherent basis for analysing classroom interactions. Finally we turn to the ways in which the framework has been used in *planning* science teaching and discuss how the framework is being used with science teachers in the context of professional development programmes, in both the UK and Brazil.

## 1. INTRODUCTION

In recent years the influence of sociocultural psychology (see, for example, Bakhtin, 1986; Vygotsky, 1978 & 1987) on research in science education has been reflected in the gradual development of interest in studies of how meanings are developed through language and other modes of communication in the science classroom. Parallel to this new focus, and in some ways interwoven with it, is the so called 'discursive turn' in psychology (see, for example, Harré & Gillett, 1994) and an increasing interest in rhetoric (see, for example, Kuhn, 1992; Billig, 1996), which have highlighted, from different points of view, the importance of investigating classroom discourse and other rhetorical devices in science education (see, for example, Lemke, 1990; Sutton, 1992; Halliday & Martin, 1993; Ogborn et al., 1996; Roychoudhury & Roth, 1996; Mortimer, 1998; Scott, 1998; Kress et al., 2001).

This 'new direction' for science education research (Duit & Treagust, 1998) signals a move away from studies focusing on individual student understandings of specific phenomena towards research into the ways in which understandings are developed in the social context of the science classroom. Sociocultural theory is one of the main traditions that has informed this research. From this perspective, concept is equated to meaning (Vygotsky, 1987) and the focus is on meaning and meaning-making. Learning is viewed, not in terms of replacing old ideas with new ones, but as negotiating new meanings in a communicative process where different cultural

perspectives meet each other in a process of mutual growth. Discursive interaction constitutes the process of meaning-making. Despite this new emphasis on talk and interaction, relatively little is known about how teachers support students' meaning making in science classrooms, how these interactions are enacted, and how different kinds of talk might support student learning.

## 2. BACKGROUND

The problem addressed in this paper, is that of analysing the ways in which the teacher can act to guide meaning-making interactions in high school science classrooms to support student learning. In responding to the problem, we introduce a framework for analysing the speech genre (Bakhtin, 1986) of science classrooms. This framework is the product of an ongoing research programme conducted over a number of years (see, Mortimer, 1998; Scott, 1998; Mortimer & Scott, 2000; Mortimer & Scott, 2003). A detailed description of the development of the framework is set out elsewhere (Mortimer & Scott, 2003). Suffice it to say for the purposes of this article, the framework is based on a sociocultural perspective on teaching and learning (Mortimer & Scott, 2003) and has been developed through a series of detailed case studies. The case studies focus on the interactions and activities of high school science lessons, in England and Brazil, in which conceptually demanding science topics (such as 'air pressure' and 'the particulate theory of matter') were taught to students aged 14-16 years.

The lesson sequences lasted for between 6 to 12 hours, and for each sequence video- and audio-recordings of both teacher-student and student-student interactions were collected. From the analysis of these data and from the insights gained from various aspects of sociocultural theory (for example, drawing on Bakhtin's [1981] distinction between authoritative and internally persuasive discourse), the framework was developed through an iterative process of application and refinement. In this paper, we introduce and exemplify two central and linked aspects of the framework and discuss implications for the wider use of the framework, both as an instrument for analysis and planning.

## 3. A FRAMEWORK FOR ANALYSING MEANING-MAKING INTERACTIONS

The analytical framework is based on five linked *aspects*, which focus on the role of the teacher, and are grouped in terms of teaching *Focus, Approach and Action*: