Assessment Implications of Representational Formulations of Learning

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Recent work in cognitive science emphasise the role of language, and the importance of personal and contextual aspects of understanding science (Gee, 2004; Klein, 2006). These new perspectives put a very strong emphasis on the role of representation in learning, implying the need for learners to use their own representational, cultural and cognitive resources to engage with the subject-specific representational practices of science. The systematic integration of representational negotiation of ideas with induction into the practices of science discourse can provide a powerful practical support for enhancing student conceptual growth. Students need to learn how to interpret and construct texts that represent science activities, reasoning processes, concepts, findings, and knowledge claims. These particular literacies of science are discursive tools, or building blocks for thinking and working scientifically, as well as the necessary components for representing scientific understandings. Tytler et al (2009) argue that scientific ideas cannot be separated from their representation, and the learning process entails harnessing students' representational resources to develop scientific ways to think about (ie represent) phenomena.

Developing understanding of science topics involves learning to represent, refine, and re-represent ideas in different modes as part of learning science literacy, rather than viewing learning as a purely cognitive process of shedding naïve conceptions in favour of scientific ones. Further to this, we argue that this representational focus has the capacity not only to productively re-interpret the student conceptions research, but can also re-configure approaches to inquiry and to reasoning in science to support conceptual learning. A representational focus based on students' active generation and evaluation of representations places reasoning and scientific literacy at the centre of the learning agenda (see also Cox, 1999; Ford & Forman, 2006; and Greeno & Hall, 1997). Formative assessment also falls naturally out of this focus (Black & Wiliam, 1998; Black, 2008).

A representational perspective challenges orthodox models of formative assessment, and implies the need for a more complex and nuanced version. Understanding and practising science involves the capacity to generate and coordinate representations which implies that representational generation and negotiation becomes the focus of teaching and learning. This focus implies significant challenges for the way assessment is framed.

The paper will draw on assessment issues generated from an ARC project focusing on representation and learning, from upper primary and lower secondary classrooms. Four middle years teachers undertook a representationally focused approach to the teaching of six units of work; two upper primary classes were taught topics on animals, energy and water whilst two lower secondary classes were taught topics on forces, astronomy and ideas about matter. Data collection included video sequences of classroom practice and student responses for most lessons that were taught, student

work, field notes, tape records of meetings and discussions, and student and teacher interviews based in some cases on video stimulated recall. Video analysis software was used to capture the variety of representations used, and sequences of representational generation and negotiation.

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We are one of three papers.