

# CONCEPTUAL UNDERSTANDING OF SCIENTIFIC IDEAS THROUGH DIALOGUE AND EXPERIMENT

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## Abstract

To tackle erroneous preconceptions about temperature, matter and energy among secondary school students, dialogue and discussion seem promising. Dialogue helps to make hidden preconceptions explicit and it further facilitates the construction of more sound scientific concepts (see Alexander (2006) and Wenning et al. (2006)). In this study we develop material and a learning method consisting of four steps: (1) Uncovering preconceptions about science through dialogue and questioning. (2) Challenging the preconception of interest by laboratory experiments and demonstration (see Longfield (2009)). (3) Offering the scientific explanation as an alternative to the preconception: students are asked to perform laboratory experiments to test the scientific explanation. (4) Confronting the new concept: students compare the scientific explanation with the preconception.

The learning material is aimed at 12 to 13-year-olds in Belgium, Spain and Lesotho. It is developed through a design based research methodology (see Barab and Squire (2004)). After developing the material according to specified design principles, the material is assessed and adjusted in several steps. In September the second research cycle is finished. It will have been tested in 3 high school classes and 5 teacher training programs. Qualitative results will be presented concerning the teaching materials, the teacher competencies and the student attitudes (e.g. the organization of the discussion, the role of the teacher, student engagement,...).

The preliminary results suggest that it is possible to engage a large part of the class group through specific exercises. It becomes apparent that teachers find it difficult to take the Socratic stance, entailing an attitude of questioning rather than answering. Additionally the first research cycles allowed to streamline the alternation between of classroom and small group discussion. The questioning attitude of the teacher might be a key factor to successfully implement the method: the teacher should promote thinking rather than give answers. A finding that has previously been discussed by Hake (1992) and Wenning (2006).

This presentation will allow to discuss how to continue and explore the relevance of dialogue for conceptual understanding.

## Keywords

Conceptual understanding, dialogic learning, preconceptions