

## **Conceptual understanding of scientific ideas through dialogue and experiment: a follow up**

*Christel Balck<sup>1</sup>, Jan Sermeus<sup>2,3</sup>, Wim Temmerman<sup>1</sup>, Bram Robberecht<sup>1</sup>, Jelle De Schrijver<sup>2,4</sup>, Beatriz Garcia Fernandez<sup>5</sup>, and Tsepo Mokuku<sup>6</sup>*

<sup>1</sup>Odisee university college, Sint-Niklaas, Belgium

<sup>2</sup>Odisee university college, Brussels, Belgium

<sup>3</sup>KU Leuven, Leuven, Belgium

<sup>4</sup>UGent, Gent, Belgium

<sup>5</sup>Universidad de Castilla-La Mancha, Ciudad Real, Spain

<sup>6</sup>National university of Lesotho, Roma, Lesotho

Students come into the science classroom with, often erroneous, preconceptions of scientific concepts. These preconceptions serve the student well in explaining the world in everyday life, but they inhibit the learning of scientific concepts in the science class. Posner suggested that the shortcomings of the preconceptions must be shown, thus allowing the students to rationally make the step from the preconception to the scientific concept [1]. Vosniadou and colleagues, and Mortimer and colleagues both continue on this idea with respectively a framework theory [2] and a conceptual profile-theory [3]. To stimulate conceptual understanding in the science classroom about concepts such as energy, we aim to continue the work of Vosniadou and Mortimer by combining Socratic dialogue [4] with hands-on experimentation. An approach is presented with six distinct steps: waking up, identifying, and challenging the preconception are followed by introducing, securing and using the scientific concept. The approach is designed and studied using a design based research methodology [5].

This approach was already presented at the 2016 Girep seminar. Where we showed that this approach has been well received by both teachers and students, that material has been developed for the concepts of energy, heat buoyancy and the particle model of matter, and that the questioning attitude of the teacher plays a key role in the successful implementation of the method (in agreement with [6]). At the 2017 Girep conference the research will have gone through all research cycles, including a large quantitative study to measure the impact of the approach on the conceptual understanding of the students with regard to the concept of energy. The impact will be measured in a pre-posttest research design. The test used is a concept-test based on the test used by Heron et al. [7]. A convenience sampling of a combined total of 200 secondary education students of ages 12-13 will be part of the investigation in Belgium and Lesotho. Additionally, a convenience sampling of a combined total of 260 teacher training students of ages 18-21 will have participated in the study in Belgium and Spain. Half of the involved students will be part of the experimental group, the other half will receive classic lectures on energy of equal length.

This presentation will present the experimental results and allow discussion on the relevance of dialogue for conceptual understanding.

[1] G. Posner (1982) *Sci. Educ.* 66 2

[2] S. Vosniadou et al (2014) *Sci. Educ.* 23 7

- [3] E. Mortimer et al (2014) Conceptual profiles, Springer
- [4] R. Alexander (2006) Towards dialogic teaching, Dialogos
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- [6] C. Wenning (2006) J. Phys. Teach. Educ. Online 4 1
- [7] P. Heron (2008) Girep proceedings