

“How Do We Pack the World Into Words?” Examining the Collective of Humans and Non-Humans in the Science Classroom

Donald J. Wink, Learning Sciences Research Institute and Department of Chemistry, University of Illinois at Chicago, [dwink@uic.edu](mailto:dwick@uic.edu)

Abstract: This paper uses Bruno Latour's framework of a “collective of humans and non-humans” to consider how to construe the non-human objects of learning and their role in classroom knowledge construction. This is done by considering materials and reports from a form of a “construction site” for science: the implementation of laboratory science in a high school chemistry classroom. The paper considers how the collective operates in three domains central to the learning sciences: learning environments, discourse, and identity. Implications for the relation of this to other ways of considering artifacts and inscriptions, including material feminisms, and for the role of phenomena in learning are also discussed.

Keywords: science, learning environments, discourse, identity.

Introduction: Preparing metals for classroom use

In the continuing saga of my [in-school] work, yesterday I completed making up all the metal pieces for two of the labs in ChemCom--the “metal / nonmetal” and the “reactivities of metal” labs. I just calculated the number of pieces this involved and it adds to about 2500. Each was 1 cm or less in size, comprised of Zn, Ag, Cu, Mg, Fe, and also carbon and silicon. Mostly easy work, though the supplier did send us some Zn “wire” that was about gauge 10. Never tedious, though, in part because it was mostly done while class was going on. I have no idea what a “Zen experience” is supposed to mean, but this has to be one.

Figure 1. Email from a science educator supporting a high school science curriculum.

Figure 1 presents a report of an event in science instruction, with many areas of exciting activity: Samples of elements are cut into pieces; a classroom is prepared for students; a curriculum is brought into schools; a chemist has an experience that contrasts with other modes of professionalism. Within this, novel attributes accrue—for the elements: a new place to be active; for the classroom and the students: new interactions with new materials; for the curriculum: a new place for use; for the chemist: new ways of seeing himself and of being seen. How can we, in such a setting, say who are the participants in this activity? What is the subject? What is the object? Are these new attributes constructed? Are they discovered? How does this incorporate the metal pieces in the discourse of the humans? And, finally, how does this activity shape and characterize the identity of those who are here? These questions go to the heart of questions about reality and knowledge construction, including especially in science. The questions are also among those central to science studies, including the work of Bruno Latour, working across the fields of anthropology, sociology, philosophy, and science, as he documents the how *collectives of non-humans and humans* are needed to understand how to answer the question of “How do we pack the world into words?” (Latour 1999).

The collective within learning environments, discourse, and identity

Three domains are considered in this paper, to document the activity of a collective in learning: learning environments, using Latour's concept of a circulating chain of reference, discourse, using his concept of speech prostheses, and identity, using a concept of the mutual enhancement and articulation of properties. Following Latour's method, a specific “construction site” for science (Latour 2005) is considered: a secondary science learning environment (Wink et al 2008; Daubenmire et al 2011).

Learning environments are complex locations where multiple actors engage on another. In his work, Latour (1999) considers a research environment, accompanying a team of researchers studying the forest / savanna boundary. The environment is a place where the things of the world become a scientific report, not through correspondence, but across “circulating chain of reference.” In much the same way, we examine how the metal is cut up to become the form of the experiment (Figure 1), the pieces are used in a chemical reaction, the reaction in a lab report, and the lab report in learning: in this construction site also, through a series of small,

traceable steps, we see how the learning environment contains another circulating chain of reference among the non-humans and the humans.

Within a construction site the non-humans become part of the *discourse*, also. This is done through a process of permitting the non-humans to speak using “speech prostheses that allow non-humans to participate in the discussions of humans, where humans become perplexed about the participation of the new entities in collective life” (Latour 2004). Within the curriculum a similar set of speech prostheses are found, permitting non-humans to enter discourse in science learning, specifically through staging of experiments, entry of results in notebooks, and claims on behalf of the non-humans in the interpretation of results.

Finally, Latour’s anthropological work is also about how humans and non-humans co-construct *identity* when they “mutually exchange and enhance their properties” (Latour, 1999) with an example focused on Louis Pasteur and the “discovery” of microbes. In this paper, a similar examination of the implementation of a science curriculum over time gives evidence about how humans (students, teachers, educators) and non-humans (metals, solutions, apparatus) also gain and stabilize identity through articulation of properties with one another. This uses methods of narrative analysis in describing identity through the emergence of metapragmatic models of identity within narrative data (Sfard & Prusak 2005; Wortham, 2001; 2004).

Implications: Inscriptions, materiality, and phenomena

There are several implications considering Latour’s collective for the learning sciences, including interesting points of comparison with work on artifacts and inscriptions (e.g, Roth et al 1999). In addition, the work will be related to concepts found in material feminisms (Alaimo & Hekman 2008), agential realism and literacy (Barad 2000) and their educational applications (Taylor & Ivinson 2013; Scantlebury & Milne 2017). Finally, the role of non-humans will be considered in thinking about the basis of phenomena (National Research Council 2012) and in association with the epistemological basis of disciplinary learning (Goldman et al 2016).

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