Reification in science education research: A neglected problem
Karim Hamza & Iann Lundegård
Department of Mathematics and Science Education
Stockholm University
SE-106 91, Stockholm, Sweden

Problem
Based on a pragmatist framework, this presentation is intended as a reminder of the problems associated with the search for underlying causes for what occurs in activities in the science classroom. More specifically, our concern is with the tendency in science education research to reify central phenomena in school science, e.g. understanding, interest, or norms.

Reification is here defined as the habit of creating entities out of human activities. This habit all too often leads to circular reasoning, the entities thus created acquiring an ontological status as structures which allegedly underlie, and thus cause, the activities from which they were generated in the first place.

Its place in the literature
The problems associated with creating entities out of human activities, and subsequently use them in order to explain these same activities, have been discussed previously both within and outside our field. Already Dewey (1925/1996) described how man, having been part of the world, eventually thought it necessary to place herself outside of it. Creating an alternative world, whether divine or rational, she could master some of the uncertainty which the messy contingencies of reality offered experience. This tendency, Dewey claims, has led to the search for underlying and universal foundations for that which we normally experience as processes in constant motion. The unprecedented success of science came as a consequence of disposing of such alleged foundations underlying natural phenomena and replacing them with relational concepts (Dewey, 1929/1996). But within psychological and sociological research this kind of essentialism remained (Dewey & Bentley, 1949/1996).

Thinking, remembering, and perceiving are examples of human activities which have become reified in psychological research (Goodwin, 1993; Säljö, 2002). Systems of remembering, originally being theoretical models fitted to psychological data, were successively given ontological status as entities of their own (Säljö, 2002). This, in turn, meant that psychologists began to pose questions about these alleged entities, e.g. “what is short-term memory?” and “what are its parts?” Psychological research is still closely tied to such entities, both in terms of cognition and values. But they have also been questioned. Thus, the universal color categories of cognitive anthropology have been described instead as actions to be learned and recreated in local and specific practices (Goodwin, 1993).

In the area of science studies, Pickering (1995) demonstrated the flaws of assuming that a certain course of events are caused by underlying structures such as constraints or limits, or that they can be explained by a purpose lying outside the activity. Pickering argued that such descriptions are nothing but rationalizations made in retrospect, thus lacking explanatory power. Similarly, Sharrock and Button (1999) and Pleasants (1999) point to the theoretical problems of using the notion of rules as an essential category for explaining human action in sociological and critical research.

In science education several researchers from sociocultural and pragmatic traditions have claimed that the entities of cognitive psychology, as well as other kinds of allegedly underlying structures, have comparatively little to offer in terms of understanding what occurs
in the science classroom (Garrison, 1995; Lidar, Lundqvist, & Östman, 2006; Roth, 1998; Schoultz, Säljö, & Wyndhamn, 2001; Wickman, 2006; Wong & Pugh, 2001).

**Argument**

Our argument is that science education suffers from its failure of relating to the wealth of literature, both within and outside of its field, already pointing to the problems with reification and with a search for structural causes for human activity. This has, we argue, unfortunate theoretical, methodological, and educational consequences.

Theoretically and methodologically, the problem is that complex and contingent processes, e.g. how students learn science, are treated in terms of underlying structures which, allegedly, explain them. This brings with it a circular reasoning affecting the conclusions drawn from empirical studies. Data is generated from human activities (e.g., interviews), but are turned into entities, for example misconceptions (Chi, 2005), propositional hierarchies (Novak, 2002), or cognitive constraints (Talanquer, 2009). These entities are then used directly or indirectly to explain exactly the activities from which they were initially generated. For example, from a meta analysis of students’ reasoning in interviews or paper-and-pencil tests, Talanquer (2009) identified a number of core assumptions which students are said to possess. Students’ reasoning during an activity such as an interview was thus converted into entities, in this case “core assumptions”, which were then located within the students. Finally, these entities acquired a function as underlying structures, viz., cognitive constraints, said to restrict students’ thinking (Talanquer, 2009). In this way, the field is provided with ever more entities whose existence and consequences become the subject of new studies. Moreover, the field ignores the requirement that two variables, e.g. (a) students’ reasoning and (b) students’ core assumptions, need to be independent in order to be treated as correlated or as one being the cause of the other. Instead, one variable (b) is first generated from another (a) and then, closing the circle, given the status of the cause of (a).

Correspondingly, the critical tradition in educational research tends to explain social phenomena in terms of norms and power. Through socio-historical analyses and analyses of the educational system certain recurring patterns of power relations are distinguished, as e.g. attitudes and identity (cf. Schreiner & Sjöberg, 2007), gender (cf. Zeyer & Wolf), and free market capitalism and globalization (cf. Jickling & Wals, 2008). And just like in the examples above, these patterns tend to be reified and turned into underlying forces that direct the outcomes of education and learning in science and environmental education. Power relations and norms thus become entities looming like ghosts behind the human activities studied.

Finally, by reifying processes such as understanding or norms, science education tends to focus increasingly on students achieving certain states, e.g. in terms of specified and differentiated competencies. Instead of directing educational activities at certain purposes and goals, the educational system focuses on the alleged competencies assumed to underlie the activities. It is of course legitimate for a teacher, observing her student reasoning critically during an activity, to call the student’s actions critical. But it is not obviously legitimate to either (a) turn the action into an entity, e.g. in the form of a competency (i.e., “being critical”), or (b) assume that it is this competency (being critical) that causes the student to reason the way she does.

**Conclusion**

Dewey was an early observer of the fact that many psychological and sociological entities are nothing but paraphrases of the very processes which they are thought to explain: 

> In the history of the progress of human knowledge, out and out myths accompany the first stage of empiricism; while “hidden essences” and “occult forces” mark its second stage. By their very nature, these “causes” escape observation, so that their explanatory value can be neither confirmed nor refuted by further observation or experience. (Dewey, 1933/1996)
Since then, the problem has been observed over and over again. Nevertheless, reference to it is lacking in most of what is published in our field, and new studies are conducted as if it had never been an issue in the first place. We therefore argue that it is of utmost importance to reopen this issue.

References


