Chapter 6

Argumentative Interactions and Learning Through a Virtual Environment: Lessons Learned from the Implementation of a Case in Science

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EXECUTIVE SUMMARY

In the scientific field, argumentative practices can, under certain conditions, help students to elaborate scientific concepts from everyday representations. However, setting up activities that enable learning in a classroom is not an easy matter. A technological environment may be useful in order to sustain argumentation and to “keep track” of the discursive processes. This chapter presents a pedagogical case in science in which the learners take part in an argumentative debate mediated by a technological environment, called Digalo. The chapter focuses on a socio-cultural perspective, thus assigning a central role to social interactions, symbolic and material mediation in development and learning processes. The author describes a case in Biology tested in two educational contexts, and discusses its psycho-pedagogical assumptions. From a qualitative analysis of the data, it appears that cognitive and argumentative processes are interconnected. This means that by articulating and making reference to the others’ arguments, learners also develop a new understanding of the scientific content. The challenges for educational issues and the lessons that may be drawn from an analysis of this case are then discussed.

BACKGROUND

Introduction

Let me start by a question that may look a bit strange at first glance: “To your opinion, what is a tomato: a vegetable or a fruit?”. People generally respond by saying that it is a vegetable. For botanists, however, tomato is a fruit, as it is the ovary, together with its seeds, of a flowering plant. It is thus a fruit, or more precisely, a berry. The term “vegetable” has even no botanical meaning, and is purely a culinary term.1 For centuries, one of the scientists’ main efforts is to try to “categorize” objects of the envi-
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ronment and to explain relationships, differences, and common points between them. However, objects are not so easily put into categories, and the definitions of categorizes evolve and change following new data or evidence. In our daily life, we, as laymen and laywomen, use categories that do not always fit with the ones the scientists have developed. Moreover, some objects of the reality can be considered as “ambiguous,” as they share characteristics of two or more categories.

It is this kind of phenomenon that some researchers in education and pedagogy take as a starting point for designing pedagogical activities in teaching sciences. Their main assumptions are twofold: starting from an ambiguous object can lead learners in science to explore the specificities of the categories that are linked to the phenomenon; and starting with a kind of “controversy question” (is A part of X or Y?) may also allow participants to enter into an argumentative and dialogical work that is at the heart of scientific activity. It is one of these pedagogical scenarios or cases that I would like to present in this chapter. It is called “Digalized Euglena”, and is based on an inquiry-oriented and socio-constructivist pedagogical perspective, using argumentation as an exploratory and learning tool. In order to sustain and facilitate the dialogical processes, the activity is mediated by a computer-mediated learning environment called Digalo that provides a graphical map of the ongoing discussion. The case is constructed around the Euglena cell that presents interesting ambiguous characteristics with both vegetal and animal properties: it shows, for instance, an autotrophism function (like plants that “nourish” themselves via photosynthesis) and, under certain circumstances, a heterotrophism function, absorbing and digesting dissolved organic matter in the water (like animals). From a scientific perspective, the Euglena cell is part of the Protista kingdom of living that gathers all the mobile and unicellular living beings together.

My epistemological position in this chapter is not the one of a teacher in science nor even a researcher in teaching science, but rather the one of a psychosociologist in education interested in the contributions and limits of argumentation mediated by a learning environment in teaching sciences, and in its psychosocial issues.

Argumentation and Learning in Sciences

In science education, it is now recognized that argumentation, under certain conditions, helps students to elaborate scientific concepts from everyday representations: argumentation means to elaborate sophisticated processes of coordination with the other’s perspective, of grounding in evidence one’s own position and negotiating it in testing hypotheses (Baker, 1999; Erduran, Osborne, & Simon, 2005; Leitão, 2000; Osborne, Erduran, & Simon, 2004a; Schwarz, 2009). Through the confrontation with other positions and decentralization processes (Piaget, 2007), participants are lead to explore and construct new knowledge. This conception of argumentation and learning is based on a socio-constructivist model of learning and on a socio-cultural approach, inspired by authors like Vygotsky (1978), Mead (1934), and Bruner (1996), who claim the important role of language, social interactions, and socio-cognitive conflicts in thinking (Mercer, 2000; Perret-Clermont, 1980; Roth, 1995).

Argumentative designs in science classrooms refer to another important issue: they allow learners to become aware of the argumentative nature of scientific reasoning. In his/her everyday activity, the scientist is familiar with argumentation in the “dialogue” s/he establishes with nature (making hypotheses, testing their validity, modifying the first assumptions and models, etc.), and with her/his colleagues and audience, through the specific rhetorical discourse used in papers, talks, etc., aiming at the dissemination of scientific observations (Latour & Woolgar, 1988). Arguments in science are of several kinds: what kind and the amount of data to collect (for instance, whether the data

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