



**“The idiots named the South North, and the North, South:”  
Co-construction of Science Culture and Negotiation of Science  
Aligned Identities in the Classroom**

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## **Abstract**

*In this qualitative study I analyze classroom interactions to understand how students and teacher co-construct particular views of the nature of science (NOS) and how these, in turn, afford or constrain students' negotiation of identities aligned to these particular views of science. The data for this study includes over two months of daily classroom video-recordings in two secondary science courses in an urban school in a large Canadian city. Ethnographic data collection methods were used, and multimodal discourse analysis constituted the analytical framework for interpreting the data. Through an analysis of students and teacher's interactions, I show how not only a particular view of the nature of science is constructed during and through this interaction, but also how students position themselves in relation to this view of science, in terms of negotiating science aligned identities. Analysis of these interactions contributes to research in teaching and learning science by exposing and turning visible otherwise invisible aspects of the culture of science classrooms that may hinder student's achievements in science, particularly in relation to students' identification with science.*

## **1. Background**

This study aims at understanding how students and teacher co-construct views of nature of science (NOS) and negotiate identities aligned with science during classroom interactions. Thus, the study focuses on how particular ways of communicating and interacting in the science classroom afford possibilities for students to negotiate identities aligned with specific views of nature of science, which are, in turn, constructed through student-teacher interactions during science classes. To this end, I combine multimodal micro-analytical approaches to classroom interaction and macro-analysis of sociocultural forms of participation available in and through these interactions, to investigate how students negotiate identities that are aligned with co-constructed specific views of nature of science and which ultimately influence students interest and learning in science classrooms.

### **1.2 Nature of Science**

Several educational documents in North America include nature of science (NOS) as a key component of scientific literacy, also recommending its inclusion as a unifying theme in curricular content at the secondary level [1-4]. Although there is no consent as to an interdisciplinary definition of nature of science [5-7], understanding of NOS is considered to be not only an outcome of science education, but also a mediator of students' experiences in school [8]. This may happen both in terms of the influence of teachers' views of NOS on their instructional methods, which are, of course, a result of a complex intertwining of several factors [9-12], and students' own understanding of NOS, which have been demonstrated to be fluid and culturally grounded to a large extent [12]. Moreover, particular views of NOS are co-constructed in interactions between students and the teacher in the science classroom; indeed, science courses always (even if only implicitly) provide images of NOS to students through the various communicative resources used in class [13-15]. This construction of a science culture structures the processes of identification and counter-identification students experience in the



classroom, thus affording or constraining students' negotiation of identities aligned with science or, more specifically, with the particular ways in which the nature of science is co-constructed in class.

## 1.2 Identity

The conceptualization of identity used in this study follows Medina's definition of identity as "something heterogeneous, based on diversity, as well as something unstable, subject to fluctuation" ([16, p. 86, italics on the original]). Identity negotiation, as an interactive and social process, takes place through a constant interplay of two networks of difference, one that distinguishes us from others within a given group, and another that distinguishes us, as members of one group, from members of other groups. The recognition of differences between *I* and *others* also engenders the recognition of similarities, which makes possible the identification with certain groups (group membership or affiliation) and of differences, which allow for the counter-identification in relation to other groups. These, however, are not fixed and immutable or stable sets of similarities and differences; there is a constant re-evaluation of what counts as similarity or difference at any given interaction. Thus, identity is always in the making and cannot be fixed once and for all. This also implies the highly contextual nature of identity: "on an absolute perspective, everything is similar to everything else and also different from everything else in an indefinite number of respects" [16, p. 91]; thus, in investigating identity construction or negotiation *in situ*, the context of the interactions needs to be taken into account. In the science classroom, the observable dimensions of the context where identity negotiation takes place includes the multimodal discourse (verbal and nonverbal communicative resources) and artefacts (material resources) interacting participants use or may refer to during interaction.

## 2. Data Collection and analysis

This qualitative study used ethnographic methods to collect data and multimodal discourse microanalysis to interpret the data. Data was collected within a two-month period in a public school at a large Canadian city, in a grade 10 Science, Technology & Environment course, with 28 students (10 males and 18 females), and a grade 11 Advanced Chemistry course, with 27 students (10 males and 17 females). The same science teacher taught both courses. All identifying information regarding participants in this study was modified to safeguard their anonymity (e.g., use of pseudonyms students chose for themselves), and expressed consent was obtained from the teacher, the students and their parents or guardians to use their image in research dissemination. Three digital camcorders were used to collect data, two fixed and one movable, focusing on the teacher and the whiteboard, the entire group of students in class, and a small group of students, respectively. I reviewed and coded all data to identify specific classroom interactional events, using tables to record the timeframe of the videos and my notes regarding events and interactions on them. I analysed episodes of interest using Adobe Premiere Pro CS4© and iMovie©. Episodes selected as illustrative were transcribed orthographically and supplemented by written descriptions of nonverbal resources (e.g., gestures, body posture) and still frames culled directly from the video records representing specific moments of interest in the multimodal analysis of these episodes. These illustrative episodes were used as evidence for the claims made as the main findings of the study.

## 3. Findings and implications

To illustrate how particular views of nature of science are co-constructed in science classroom interactions and how these influence students' negotiation of identities aligned with science, in my presentation I discuss two episodes from the grade 10 course where the teacher and the students engage in conversation regarding particular science content, which is also imbued with implicit views of NOS. The first episode unfolds while the teacher presents the topic of magnetism to grade 10 students. In this event, teacher and students engage in a conversation about the magnetic and



geographic north and south, after the teacher explains that these differ. After some discussion, one student summarizes the debacle by stating the geographers misnamed the north and south poles:

Teacher: *Basically geographic south is a magnetic uh north, geographic north is a magnetic south because magnetic forces goes from north to south*

Student: *The north is the south and the south is actually the north, but the idiots, they named the south north and the north south*

The second episode involves a discussion about energy efficiency, in which a student disagrees with the teacher's statement and proposes that a perfect system should provide more energy output than input; the teacher rebukes the student, suggesting they have different definitions of "perfect system":

Teacher: *In a perfect world (...) where there is no waste (...) the amount of electrical energy that you put in should be the amount of heat energy you receive by the water*

Student: *Sir, wouldn't in the perfect world the system would be energy input equals less than the energy output?*

Teacher: *Course not (...) that means you are creating something from nothing*

Student: *No you are creating something from something*

Teacher: *Maybe I guess (...) your definition of perfect is different from my definition of perfect*

In both episodes, the ways in which NOS is co-constructed through both students and teacher discourse is evident. Through an analysis of similar students' and teacher's interactions, in this study I show how not only a particular view of the nature of science is constructed, but also how students position themselves in relation to this view of science, in terms of negotiating science aligned identities. Some of the very characteristics that are considered scientific in this context correspond to what Medina [16] has referred to as socially fixated and stereotypical aspects of one's identity that ultimately produce privileged identities and, consequently, marginalization of individuals who counter-identify with such aspects of these privileged identities. Discussions of school science culture, including NOS, and its (re)production in student-teacher interactions in the classroom are situated at the core of teaching and learning debates in science education. Analysis of these interactions contributes to research in teaching and learning science by exposing and turning visible otherwise invisible aspects of the science classroom that may hinder student's achievements in science, particularly in relation to students' identification with science.

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