

# Grammatical processes of objectification in a middle school science classroom

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## Abstract

This paper focuses on the discursive and grammatical means by which science students extract and objectify knowledge from the dynamics of the laboratory setting. I argue that nominalization is a particularly important strategy by which this curriculum unit and teacher apprentice students into objectifying the data, evidence, and conclusions from the labs. This paper shows how students are tasked with mastering an unusual locution: the use of the verb ‘to weigh’ as a noun in the subject position, with atypical syntax, semantics, and pragmatics. I suggest that these novel nominalizations are a way that inquiry-based curricula apprentice students into an ideology of scientific research that backgrounds potentially fallible researchers and their technology, and privileges instead the inscriptions that are the products of that lab work. Evidence is presented showing that students adopt and even extend the unusual nominal constructions involving the lexeme ‘weight’.

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## 1. Introduction

Recent work in science studies has highlighted the social nature of knowledge production in science and has drawn attention to the important role played by the scientific community, acting in the Literature, in coming to agreement about what should count as a discovery, or a new fact, in a given field (Jasanoff, Markle, Petersen, & Pinch, 1995; Latour, 1987). Traces of the process by which knowledge claims become facts – the blackboxing process Latour and Woolgar (1979) describe – may be seen through rhetorical and sociocitational analyses of primary research articles (Viechnicki, 2002), despite an ideology that rhetorical considerations are immaterial, as the data alone “speak for themselves” and solely determine the fate of any given knowledge claim. This paper assumes that a grammatical strategy of objectification characterizes scientific discourse in which nominalization plays a critical role as a way to “hold reality still” (Halliday & Martin, 1993), objectifying or “thingifying” key elements of it, decontextualizing and desubjectifying it (Markus, 1987). Nominalization is assumed to be a key strategy by which scientific research articles attempt to increase their knowledge claim’s chances at going on to facthood. This paper argues that the curriculum materials of *Chemistry That Applies (CTA)* (State of Michigan, 1993), and the teacher enacting those materials, model this process of objectification for students, using nominalization, and other unusual nominal forms involving the lexeme *weight*, in order to “hold still” and otherwise make real key elements of students’ laboratory activities in this inquiry-based unit.

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Linguistic and discursive data are presented from (1) the written text of the curriculum materials, (2) the spoken discourse of the teacher, and (3) the spoken discourse of the students, in order to argue that nominalization is a way by which students are apprenticed into understanding that their laboratory activities have produced data, which is in fact compelling evidence demanding an explanation involving the existence and predictably conserved behavior of the natural objects atoms and molecules. Students are apprenticed into seeing how the arrangement of atoms and molecules change in physical and chemical reactions – into this “professional vision,” so to speak (Goodwin, 1994) – at least in part by learning to use the otherwise non-technical term *weight* in newly technical ways. This paper describes how the enacted curriculum unit ‘scientizes’ this term for pedagogical purposes, and document how students adopt the unusual nominalizations, even generalizing and extending them.

The force of this argument comes from the fact that the uses of *weight* that are modeled in the text of *CTA* and the speech of the teacher are non-normative, pragmatically, semantically, and syntactically. As will be shown below, for example, *weight* is referred to semantically as a property of mixtures and systems and as a possession of atoms and molecules. The teacher and text also modify *weight* with the time adverbials “before” and “after” as well as atypical prepositional phrases, such as “in gas” or “in liquid.” These noun phrases also frequently appear in syntactic subject position. A survey of normative uses of weight in radio broadcast transcripts (the results of which appear in the Appendix A) provides evidence of the atypicality of these uses, and supports the argument that the selectional restrictions on *weight* are specific to this context, and are used in *CTA* in order to forward a particular conceptual point.

## 2. Background

The goal of this background section is to draw connections to research focusing on the linguistic characteristics of written scientific discourse, especially on the reporting of the discovery of natural objects (Gross, 1996; Cambrosio & Keating, 1995; Viechnicki, 2002), as well as to studies which investigate this process ethnographically and trace how novices in the field learn to appreciate natural objects (Banach et al., 2002; Goodwin, 1994; Latour, 1995). This section furthermore describes studies which underscore the importance of evidence such as is presented here, in that they argue that learning to “talk science,” as the students described in this paper are learning to do, indeed is learning to “do science” (Lemke, 1990; Roth, 2005). This section also outlines studies which suggest that the significance of the objectifying moves this curriculum unit helps students to make (objectifying the data, evidence, and explanations from lab work), especially as it regards to their critical reasoning skills (Duschl & Ellenbogen, 2002; Kelly & Crawford, 1997; Osborne, 2001). Finally, this section briefly reflects on the pedagogical and rhetorical structure of the curriculum materials under study.

### 2.1. Science studies

Latour and Woolgar (1979) offer a social constructivist account of the evolution of facts or knowledge objects – what become a field’s “psychological tools” (Vygotsky, 1981)<sup>1</sup> – as taking place in, and in-between, research articles over time. As a knowledge claim comes to be accepted within the community, it is gradually detached from its context of discovery. The historical localizability of the experiment, and eventually the researchers involved, fade, and the knowledge claims is “black boxed” – its particulars no longer available for discussion or critique. As the process by which adjectives and verbs are transformed into nouns, nominalization plays an important role in this factivization process, constructing phenomena as “things,” thereby lending them a “sense of objectivity” or “fixity of meaning” (Halliday & Martin, 1993). Transforming some process into a noun phrase implicates that information is presupposed, and hence less negotiable than it would be in a verb phrase.

Parts of a laboratory experiment, a process, or even one’s results may be objectified in this way, and turned into “figures” in the discourse in Goffman’s (1981) terms, which can act as agents in the discourse. For example, “this effect” or “the deduced protein sequence” – as syntactic subjects – can demand an explanation, or demonstrate one’s conclusions. Latour and Woolgar use the term “phenomenotechnique” to capture this process, where inscriptions such as measurements or graphs are reified and made the focus of ensuing discussion, backgrounding the intermediary steps (the machines and people) that produced them (1979, pp. 63–64). Nominalization thus plays an important role

<sup>1</sup> Also called “intellectual tools” (Vellom et al., 1994) or “mediational means” (Wertsch, 1981, 1991).

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