Objectification and the inscription of knowledge in science classrooms

Lindsey A. Massoud*, Joel C. Kuipers

Department of Anthropology, The George Washington University, 2110 G St. NW, Washington, DC 20052, USA

Abstract

In this paper, we explore objectification as a form of participation in socially defined activities. We explore objectification as it manifests in language (through, e.g., nominalization), entextualization, writing, perception (through the objectification of sensory experience), and identity formation. We document how these practices have been explored in the past, from philosophical, ethnographic, linguistic, and other perspectives. We group them under the common theme of objectification in order to demonstrate how all of these practices function to represent processes, actions, or relations as objects. We explore the prevalence of these processes of objectification in social life and suggest implications for learning, and specifically science learning.

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1. Introduction

In a middle school science classroom in the suburbs of Washington, DC in 2003, an ethnically and linguistically diverse group of 8th grade students, Philip, Natalie, Gloria, and Sean, discuss the answer to a written question about a scientific phenomenon they are observing at their table. Prompted by a new set of experimental curriculum materials, the students repeatedly refer to, point to, and even make pictures of, the objects of their discussion as these things lie on the table before them. At the same time, they position themselves socially, linguistically, textually, perceptually, and graphically in relation to these socially constructed objects in a version of what Knorr-Cetina (1999) calls “object-centered sociality.” The focus of their verbal exchange is Gloria’s inquiry about which word to write down – “physical” or “chemical” – to describe what happened to the substances in the middle of the table. Natalie responds, labeling the demarcated event as “chemical”; when Philip joins in, he nominalizes the adjective “physical,” recalling a reaction they previously observed as “that one physical.” Gloria twice reframes her original question, repeatedly referring back to her own speech (e.g., “but I’m saying”), thereby creating an objectified, metarepresented verbal text through quotation and repetition. We argue that many of these varied student practices share “objectification” as a common feature.

The clip transcript in the table below describes briefly how we think students create varied objectified representations through particular acts of participation throughout this interactional sequence. We will elaborate the descriptions of each of these ethnographically observable manifestations of objectification throughout the paper (Table 1).

There are at least five reasons for calling attention to objectification as a process: (1) it describes a fundamental process in cognition and social life; (2) this process has been described differently by different disciplines and we think

* Corresponding author. Tel.: +1 202 994 3784; fax: +1 202 994 6097.
E-mail addresses: lamassoud@gmail.com (L.A. Massoud), kuipers@gwu.edu (J.C. Kuipers).
Table 1
Transcript of classroom interaction among 8th grade science students

<table>
<thead>
<tr>
<th>Transcript</th>
<th>Type of objectification</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gloria: Is <em>this</em> physical or chemical change?</td>
<td>Objectification of sensory experience</td>
<td>Gloria represents a process that occurred as a singular thing, “this.”</td>
</tr>
<tr>
<td>2 Sean: Chemical.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Natalie: It was, chemical.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Gloria: Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Natalie: Because physical…okay did it evaporate or something? Well, did it change because of temperature?</td>
<td>Nominalization</td>
<td>Philip uses the adjective “physical” as a noun and the sentence “the temperature changed” as a noun phrase.</td>
</tr>
<tr>
<td>6 Philip: <em>That one physical that was a temperature change</em>, yeah, that was because the water left. If we kept it there then it wouldn’t have changed.</td>
<td>Nominalization</td>
<td>Philip uses the adjective “physical” as a noun and the sentence “the temperature changed” as a noun phrase.</td>
</tr>
<tr>
<td>7 Gloria: <em>I’m asking</em> if it’s a [chemical or physical change].</td>
<td>Entextualization</td>
<td>Gloria creates a more durable verbal text of her own speech by repeating it and referring to it.</td>
</tr>
<tr>
<td>8 Philip: [Like, if we would’ve boiled it – you put it –] put – if we had boiled it and put like a lid [on top or something.]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Gloria: <em>Okay that’s alright</em> but <em>I’m saying</em>, is it a physical or chemical change?</td>
<td>Entextualization</td>
<td>Gloria continues to create an increasingly durable verbal text of her own speech by repeating it and referring to it.</td>
</tr>
<tr>
<td>10 Philip: This?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Gloria: Yeah.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Philip: Chemical.</td>
<td>Nominalization</td>
<td>Philip refers to the reaction (“this,” line 10) as a singular noun, “chemical.”</td>
</tr>
<tr>
<td>13 Gloria: Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Natalie: Because <em>it</em> made a new substance with new properties.</td>
<td>Objectification of sensory experience</td>
<td>Natalie refers to the reaction as an agentive thing, “it,” as the subject of the sentence.</td>
</tr>
<tr>
<td>15 Philip: Yeah.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Sean: With new properties.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Philip: It’s like, it [als- also seems like one] substance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Gloria: [And it’s not irreversible.]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Sean: And it’s irreversible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Philip: As far as we know at least.</td>
<td>Writing</td>
<td>Gloria graphically objectifies an answer to the question, after “chemical” has become hardened (objectified) verbally as an answer for the curriculum’s prompt.</td>
</tr>
<tr>
<td>21 Sean: Yeah.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

they all benefit when we identify a common theme; (3) it may help explain things that are often difficult to understand – i.e., the relationship between social participation, cognitive development, and student outcomes as reflected by test scores; (4) it is a methodological improvement because it reliably links codable forms of participation to interactional processes; (5) it helps us think about science as a social process and thus avoid problematic epistemological distinctions such as objectivity/subjectivity.

We broaden Halliday and Martin’s (1993, p. 52) definition of objectification to conceive of it as the act of representing a process, action, or relation as an object or thing. Since at least the time of Hegel’s discussion of the master/slave dialectic in terms of objectification, the term has had negative connotations. For Hegel, it referred to the act of positioning others as objects for the benefit of the self (Hegel & Marheineke, 1832 [1968]). Marx drew on Hegel, but focused on how the process of working was objectified as “labor” – thus turning it into a commodity to be bought and sold. This act of objectification, he believed, gave rise to inequalities in human societies and indeed to the oppression of the working
participation in socially defined activities. Following Goodwin and Goodwin (2004, p. 222), so.

In cognitive fields of study, objectification as a concept has not always been so freighted with moral connotations. In their Metaphysics in 1859, Hamilton, Mansel, and Veitch speak of “this discrimination of self from self, this objectification, is the quality which constitutes the essential peculiarity of Cognition.” Principia Cybernetica also suggests a more neutral cognitive understanding of objectification: “We often think and speak about a process as something definite, constant – in other words, as an object. Then we objectify it, i.e. replace the process, in reality or in our imagination, by an object. The most usual form of objectification is definition.” (Turchin, 1991). Additionally, Hegel, taking a more neutral standpoint, described the objectification of one’s own ideas as a crucial element of self-creation, arguing that “all human history is a process whereby ideas objectify themselves in material reality” (Löwith, 1964, p. 266).

In this volume, we neither wish to praise objectification as part of cognition, nor to condemn its role in social relations yet again. Rather, in light of Keane’s (2003) recent call for an ethnographic analysis of objectification as a human activity, we wish to explore what it is and how it manifests in everyday human interaction. Keane (2003, p. 223) urges that we “take seriously the materiality of signifying practices and the ubiquity and necessity of conceptual objectification as a component of human action and interaction.” Furthermore, he implies that it is intrinsically neither good nor bad, but rather that value judgment depends on how it is used as a human practice: “in contrast to the romantic critique of objectification as, say, inherently alienating or a violation of self-presence (see Miller, 1987), whether objectification is negative or not is a function of who I am for you and what epistemic status I accord that moment of objectification” (Keane, 2003, p. 239). Objectification, then, is an interrelational semiotic practice, and as such, has important social and epistemological consequences, which, although potentially negative, are far from being inherently so.

In this issue, we wish to push the notion of objectification a bit further, exploring objectification as a form of participation in socially defined activities. Following Goodwin and Goodwin (2004, p. 222), participation “refers to actions demonstrating forms of involvement performed by parties within evolving structures of talk.” This includes actions by which participants display to one another what they are doing and how they expect others to align themselves toward the activity of the moment. They further emphasize a multi-modal framework that considers a variety of relevant aspects of the social setting, as well as how participants “build action together while both attending to, and helping to construct, relevant action and context” (Goodwin & Goodwin, 2004, p. 240). This building of context often includes the objectification of aspects of the social setting, including physical objects, as epistemological objects that constitute the focus of interaction.

Here we further draw on the work of Lave and Wenger (1991), for whom participation stands for actions that are more or less peripheral to culturally defined activity systems. In this model, cognition is not viewed as something occurring exclusively inside people’s heads, but rather as a public and collaborative event among participants. As a form of participation, cognitive activity is something to which one can be apprenticed, and gradually come to master as an expert. In light of this theory of learning as participation, we view objectification as a shift in frameworks of participation and practice within culturally defined activity systems. In this issue we will consider the implications of this analytical move for ideas about learning, particularly science learning.

Objectification is often viewed as involving a transformation of consciousness; but since this change in interior states is not observable, we aim to find manifestations of objectification in the discursive and ethnographic record of interaction. The papers in this issue focus on evidence of objectification in the discursive practices of a group of 8th grade students in a middle school science classroom during implementation of a curriculum unit entitled Chemistry That Applies (CTA). The authors of the papers in this volume demonstrate how students objectify various features of the social setting through linguistic objectification, entextualization, writing, objectification of sensory experience, and identity formation.

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1 Keane labels this objectualization: “for all their differences, both Marx and Heidegger offer accounts of objectualization, the conditions for the constituting of objects – above all, as objects of cognition (Keane, 2003:416, emphasis in original).”
A number of words describe processes related to objectification: inscription, reification, hypostatization, embodiment, actualization, externalization, realization, even estrangement. While one or more of these words, among potential others, could conceivably be used as a substitute, as our focus is on science classrooms, the term objectification, which resonates with notions of scientific objectivity, seems most appropriate to our interests.

Our choice of setting for this discussion, like our choice of terminology, exists among reasonable alternatives but offers benefits to the kind of ethnographic exploration of objectification that we are undertaking. We believe that science classrooms are ideal settings in which to examine objectification in practice. Classrooms in general tend to be places where knowledge is broken down into digestible chunks, often packaged and re-packaged into different forms in relation to the different subjective perspectives of the students. Science classrooms are especially worthwhile subjects of investigation because they display many aspects of the “object-centered sociality” that Knorr-Cetina (1999) says characterizes adult science laboratory culture. According to her, science is a culture in which participants define their relations to each other by their orientation toward common physical and epistemological objects.

In this paper, we will attempt to place some salient features of objectification in the context of relevant anthropological, linguistic, educational, and philosophical literature. We will show the importance of linguistic objectification, entextualization, identity formation, literacy events, and objectification of sensory experience as elements of the semiotic construction of classrooms activities, and argue that an important common theme that they all share is objectification. We will provide brief references to the ways in which the essays assembled here fit into those themes, but we will leave the elaboration of the themes to the authors themselves.

2. Linguistic objectification

First, we will consider ways that objectification manifests linguistically, through the construction of objects made from linguistic resources, such as words and sentences. These include nominalization – the construction of a noun or noun phrase from a verb, adjective, or sentence – and verbal objectification (Wright, this issue-a) – the construction of a durable representation of a process or event with a single (often nominal) word.

2.1. Nominalization

The first ethnographic example of linguistic objectification we wish to consider is nominalization. Nominalization is the grammatical process of turning a verb, adjective, or sentence into a noun or noun phrase. It is a nearly universal feature of languages, although it may appear more often in certain languages or speech registers. In effect, nominalization “thingifies” and thus “objectifies” an action, process, or description. Most languages permit the nominalization of at least some verbs, and when they do so, the resulting expression is typically semantically and/or grammatically “marked.” Croft (2003, p. 141) observes that “basic verb concepts, denoting processes and actions, are marked when they serve as referring expressions (nominalizations, complements).”

In the realm of education, nominalization has been used to describe processes of knowledge construction and reproduction. According to the educational philosophy of John Dewey, the focus of education should not be on knowledge, which seems to be a static “thing” that we acquire, but on inquiry, which is an activity. As Rockwell (2001) observes,

For Dewey, ‘knowledge’ was rather like a nominalization of a verb, rather than a genuine noun, and he was vigilant in exposing the confusions that resulted from ignoring this. Much of his Democracy and Education is devoted to exploring the damage done by the assumption that knowledge is a commodity, and that the goal of education is to cram as much of that commodity as possible into a person’s memory.

This emphasis on turning processes into objects, which can be accomplished through linguistic resources such as nominalization, has therefore been influential in the development of educational theory in the U.S.

Nominalization as a process has also attracted the attention of philosophers, literary critics, and linguists for nearly a century. In an early discussion of nominalization, Russell (1937) argued that nominalization was problematic for the creation of assertion, saying that the truth of a sentence is no longer verifiable once the sentence is nominalized – the meaning becomes merely implied. Because he was concerned with truth value, Russell dealt with sentential nominalizations, which consist of a subject and a nominalized verb, not with nominalizations composed of a single nominalized word. For example, take the sentence, “The murder of Tom Smith was deplored by Dan Jones.” Russell
would argue that this sentence does not actually claim that Tom Smith was murdered, but rather that it only claims that Dan Jones deplored the implied or assumed murder of Tom Smith.

What concerns us here are the implications of Russell’s observations for nominalization as a form of participation. Inasmuch as “the murder of Tom Smith” is contained in a nominal phrase whose truth value cannot be verified, this grammatical move places the nature of Tom Smith’s demise in the background, in the realm of implicit knowledge. Any challenge to this knowledge would be marked interactionally, and more disruptive of the social interactional flow. As a linguistic practice, nominalization is part and parcel of the process of establishing and maintaining “face” and indeed one’s authority in the context of social interaction.

Vendler (1967) is also interested in sentential nominalizations that represent ideas embedded in other ideas. He describes two main ways that a nominalized sentence can be incorporated into another sentence. The first is by use of a restrictive clause (e.g., “The man you love must be generous” derives partially from the statement, “you love a man”). The second is by what he calls a “proper nominalization,” where a sentence is nominalized and placed into a “noun gap” in another sentence, or a lexical requirement of a noun complement. In this second case of proper nominalizations, Vendler distinguishes four elements: (1) nominal: a noun phrase formed as a product of a proper nominalization; (2) matrix: a sentence before it is nominalized; (3) container: a sentence with a noun-gap requiring a nominal (rather than an un-nominalized noun); and (4) nominal compound: the resulting sentence consisting of the container and the nominal. We find that this categorization can be helpful in examining ethnographic data of nominalized phrases, because it offers a structural framework for describing variation in nominalization practices and their impact on participation.

Within the field of formal linguistics, detailed work on grammatical aspects of nominalization began with Lees’ The Grammar of English Nominalizations (1960), where he argued that nominalization is a grammatical process deriving a noun phrase from a verb phrase or sentence (representing a transformational approach to the topic). Chomsky called this into question in his Remarks on Nominalization (1968) by contending that the lexical constraints on a verb or adjective affect its nominalization. In an apparent exception to Chomsky’s well known syntacticism, he cited the example of (with a star indicating an ungrammatical phrase):

John is easy to please
John is eager to please
John’s eagerness to please
BUT:
*John’s easiness to please

Easy and eager are grammatically similar, but they have different semantic constraints which govern their nominalization. Nominalization is therefore not solely a grammatical process; the meaning of the words affects, and is affected by, the process. This has implications for our work because word meaning is crucial to learning and knowledge as it is built through language. When words are nominalized, their meaning affects the grammatical process and therefore affects the process of building implicit knowledge through language.

These philosophical and linguistic descriptions of nominalization are somewhat helpful in beginning to understand what students are doing when they nominalize. However, they do not address the uses of such grammatical constructs as part of a social context; this kind of inquiry began only more recently. One of the first efforts to do this was the work of Halliday and Martin (1993), who examined the role of nominalization in scientific writing. Some might go so far as to argue that nominalization is a defining characteristic of scientific writing and scientific thought. For example, insofar as scientific thinking is cumulative, and builds on previous discoveries, nominalizations also place knowledge depicted in previous sentences as the subject of a new one.

e.g. (1) The water decomposed.  
(2) The decomposition of water involved forming new molecules.

Communicating the idea represented in sentence (2) through language requires that the idea that “the water decomposed” be placed in the subject position of another sentence. An English speaker cannot say, “The water decomposed involved formation of new molecules,” and therefore the first sentence (a matrix in Vendler’s terminology) must be put into a nominalized form (Vendler’s nominal) so that it can be implied and added to in the second sentence, the product of which Vendler terms a nominal compound.

Nominalizations also represent a kind of syntactic “black-boxing” (Latour & Woolgar, 1986), in which the nounifying or “thingifying” process of nominalization disguises its own agency – where it came from, who made it, how it came to be. Latour argues that in the process of developing scientific knowledge, laboratory scientists eventually come to accept certain claims as “true,” thus placing them into a “black box,” protected from epistemological challenges and peer
critiques. In the same way, nominalizations harbor an implicit claim, but—as Russell pointed out—they do not overtly make an assertion that can be contested. For example, in the sentence “the weight changed...,” the word “weigh” is objectified in the sense stated at the beginning of this essay: it represents a process or action (i.e., “to weigh”), that the students themselves enact in this curriculum, as an object or thing (i.e., “the weight”).

Insofar as learning science is a matter of learning how to “talk science” (Lemke, 1990; Roth, 2005), nominalization can be viewed as a way of participating in a scientific community of practice. When students use nominalizations appropriately, it has observable consequences for the ways in which they interact with others at their lab tables. It affects how they fashion their identities, as well as their relative authority as sources of scientific knowledge. An important question that remains is how the use of nominalizations is linked to more traditional measures of scientific knowledge on assessments.

In the paper by Viechnicki (this issue), 8th grade children in a culturally diverse science classroom in the Washington, DC suburbs struggle to use language to represent one of the more difficult ideas in middle school science: the conservation of matter. Since it is not practical for classes to observe matter by looking at atoms and molecules that make up substances involved in physical and chemical reactions, students experience the conservation of matter by measuring expected and actual differences in how much objects weigh before and after certain observed changes. Part of the process involves teaching the students to master what is for them an unusual locution: the use of the verb “to weigh” as a noun in the subject position.

2.2. Verbal objectification

Related to nominalization is Wright’s (this issue-a) concept of verbal objectification, or the process of stabilizing some word(s) (often a noun or noun phrase) as a representation of a perceptual experience that itself has been objectified. In other words, this process could be considered to be the verbal objectification of a previously objectified perceptual object, such that one could talk in the form, “this (the perceived object) is this (the verbal object).” It follows perceptual objectification, or the objectification of some part of the sensory field, which will be discussed later. This manifestation of objectification thus converts perceived elements into cognitive objects that are linguistically “summed up” and referred to with some term or phrase.

Because verbal objectification harkens back to a process or event, it necessarily involves resemiotization, or translation of meaning from one semiotic mode into another (Iedema, 2001, 2003). A multi-modal approach to communication, as put forth by Kress and van Leeuwen (2001), posits that language is one of many modes of semiosis, and the many ways in which humans communicate must be examined ethnographically, one not given analytical preference over another. Resemiotization describes how these different modes of semiosis are managed over time by converting messages from one mode into another, the newer mode often being the more durable, creating a form that is more object-like (e.g., converting talk into writing, as when a page’s worth of meeting minutes are constructed from an hour or so of the more ephemeral discursive mode).

In this case, a linguistic object that becomes a durable classroom resource (repeatedly recontextualized and referred back to) is a translation of an objectified moment of perception. Students see an “event” and come to label it with a concise, durable, scientific representation based on the teacher’s prompting. The way that a word or phrase can be objectified and made more durable in this way is through intertextual relations built between moments of semiosis. In Wright’s example, students see a process occurring in the beakers in front of them (mainly in the visual mode), and the teacher labels it “gas.” Later the students have a similar perceptual experience, and the teacher offers clues that this perceptual “thing” is related to some “thing” that happened before. When the visual and linguistic connections to this past event are made, the students come to see these instances as tokens of a type. The type is represented via the verbal object (“gas”) that is becoming stabilized for the students, able to be drawn upon in new contexts of learning.

Latour and Woolgar (1986) demonstrate a similar phenomenon by exploring how facts are constructed through the actions of scientists in a science laboratory as well as how the products of those actions (namely, written documents such as research articles) interact with the larger community of scientists and the documents they have produced. Latour and Woolgar show how a simple “eight syllables” (Latour and Woolgar, 1986, p. 148) – the chemical formula for a particular molecule of interest – took on factual status and became an object of scientific inquiry, accepted as background knowledge in future articles and scientific experiments. The process of labeling and summing up laboratory experiments in a classroom and in a professional science laboratory are similar in that a particular word or phrase is solidified as the summary statement of the actions of students or scientists, and this word or phrase is objectified in
such a way that it becomes recontextualized in future experiments, discussions, and written summaries of lab results, able to be built upon as scientific inquiry continues.

When verbal objectification occurs, the processes whereby the verbal object was constructed fade over time in the communication between persons interested in the object. As it is hardened and takes on an increasingly object-like form, its creation is nearly forgotten as it becomes useful in other contexts, where it is built upon in the further construction of knowledge. In Latour and Woolgar’s (1986, p. 105) words, a fact is “freed from the circumstances of its production.” Regarding resemiotization, Iedema (2001, p. 25) similarly notes that “with each step the process reconfigures the situation which is posited as its origin.” It is, in this way, similar to entextualization, which will be discussed next.

3. Objectification of texts: entextualization

Much as words and phrases can be objectified, so can whole stretches of spoken discourse and other assemblages of signs. Language not only affords many ways of objectifying spoken texts, including poetic parallelism, reported speech, performative formulae and other devices (Bauman, 1977), but also many ways of recontextualizing them. Bauman and Briggs (1990, p. 73) define entextualization as “the process of rendering discourse extractable, of making a stretch of linguistic production into a unit – a text – that can be lifted out of its interactional setting.” In our sense, entextualization is a verbal and interactional process whereby some group of signs, often a stretch of discourse, is objectified.

Whereas Bauman and Briggs (1990) focus on entextualization as exemplified in performance, Silverstein and Urban (1996) describe entextualization and re-contextualization within a broad range of social interactional events, showing how this process is linked to issues of power, authority and social control. For example, John Haviland’s (Silverstein & Urban, 1996, pp. 45–78) study of the language of newly literate Zinacantecos, shows how they produce written texts that add features not found in oral discourse, and which reflect norms about proper text-objects. In a study of third grade classrooms, James Collins (Silverstein & Urban, 1996, pp. 203–228) shows the role of power in defining what gets to count as a “text.” Interruptions and use of local dialect forms are seen as taking away from the autonomy of a text, and hence its authority as an example of “good reading.” “Poor readers” are ones who fail to objectify the text as separate from its social context. These skills, Collins notes, do not necessarily prepare them for the situated practices of literacy in wider contexts, but they do reflect the current ideology of entextualization in the United States. In another paper in the same volume, Elizabeth Mertz (Silverstein & Urban, 1996, pp. 229–249) shows that in law schools, the opposite strategy is required. It is only those students who are able to situate case materials phonologically, semantically and pragmatically, that are considered to be successful readers of case materials.

The use of reported speech to quote, re-frame, and/or re-voice the discourse of others is another important way in which objectification as entextualization plays a role in everyday practices. By re-producing the words of others as in a quote, we not only position ourselves rhetorically vis-à-vis the discourse of someone else, we also position that discourse grammatically, semantically, and culturally as a textual “object,” a verbal thing to which we can refer.

Narratives are a frequent analytical object for researchers interested in reported speech (e.g., Otanes & Hale, 1986; Bassano, 1988; Maybin, 1996; Kaderavek & Sulzby, 1997; Levey, 2003). Narratives also often play a role in organizing classroom interactions. Within the science classroom, students refer back to previous classroom discourse, which can be interesting for peer social interaction (e.g., humor), or can help students make sense of a current lab experiment or worksheet question. These narratives can in turn have consequences for what comes to count as an authoritative response and what gets graphically objectified on worksheets.

This process of reporting the speech of others is, in many social contexts, richly intertwined with systems of authority. In the eastern Indonesian island of Sumba, the verbal and poetic process of ritual atonement for neglect of ceremonial obligations to ancestral spirits is one of the most important moves in the legitimation of systems of political and religious authority (Kuipers, 1990). While the richly dialogic, quote-filled divination process is not viewed as authoritative, the subsequent somber and monologic ‘chants’ are less likely to provoke debate, and are regarded as derived from weightier and more stable sources. These chants are seen as authoritative text documents with broadly enforceable restrictions on the audience. The process whereby discourse is rendered extractable is one in which it becomes more and more thoroughly patterned, poetically, as well as interactionally.

In his book, Talking Science, Roth (2005) describes the process by which students’ discourse in science labs becomes progressively more “stabilized” and thoroughly patterned in the process of discovery. It begins with a moment of
recognition of the problem, followed by semiotic ostension, or verbal indexical identification, followed by verbal “replication” or model building, in which the problem is discursively represented textually (Roth, 2005). In our study, we are not only interested in the formal processes of signification by which discursive texts are constructed, but in their social consequences for participation. Just as in Sumba, the building of authoritative texts has implications for who, when, and how participation occurs in key acts of symbolic exchange. In science classrooms, the construction of authoritative accounts of scientific truth has consequences for structures of participation at the lab tables. When discourse becomes entextualized, opposition to the text becomes interactionally awkward, because the text has become an epistemological and interactional object in that setting.

Part of the power of objectification comes by its capacity to obscure its own indexical creativity, and to make it appear that it is only encapsulating and representing what is already there, when in fact it is creating something new. Sumbanese ritual chanters make their final chants appear to be transparent representations of something ancient when in fact of course they are creative entailments (in Silverstein’s terms) of the current circumstances. Science students come to conclusions about Nature based on classroom interactions, lab experiences, and other semiotic constructions. When these processes of knowledge construction are hardened through entextualization, these texts, as objects, appear as facts, not the end result of interactional processes. This gives them authority within the classroom, as they are accepted as knowledge, and then increasingly as background knowledge to be built upon.

There has been very little, if any, work done to date on entextualization in science (but see discussion of Viechnicki (2002) below), and particularly little in science education. We argue that scientific and educational data can contribute significantly to the discussion of entextualization as a semiotic process of participation, and that this can include acts of scientific performance. One way that students use a text that has been previously decontextualized is by calling on the curriculum materials or a textbook for authority in answering questions or discussing ideas with other students. In this way, they give authority to their own ideas that are supported by the curriculum text, they entextualize the language they are using from the text within the particular social situation in which they are participating, and they gain access to scientific discourse by recontextualizing scientists’ and educators’ written ideas within their own experiences. In a similar way as nominalization and writing, entextualization allows science students to learn to build new knowledge upon previous knowledge, and to participate more fully in a scientific community of practice.

What we have laid out here is an account of entextualization which focuses on the hardening of particular forms of cultural texts, or “configuration[s] of signs” (Hanks, 1989, p. 95). This “hardening” makes semiotic forms more thoroughly structured, causing them to be somewhat less likely to be altered in the course of social interaction. However, entextualization has also been used to describe the fixing of ideas or meanings through various semiotic forms over time. The construction of scientific facts could be considered entextualization in this sense. Viechnicki (2002), for example, describes in detail the process of the construction of facts and the hardening of scientific ideas through sociocitational structures in scientific writing, detailing how these structures construct facts over time. Wortham (this issue) uses a similar definition of entextualization to describe identity construction within interactional events. He uses the term to describe “how speech comes to identify individuals in practice,” arguing that identifying signs “only come to have more definite meaning over the course of a discursive interaction, as subsequent signs recontextualize or reinforce earlier ones.” In Viechnicki’s and Wortham’s accounts, then, it is meaning (of ideas, facts, identifying terms, etc.) that is hardened over time, whereas we have described a view more focused on the objectification of particular forms (e.g., the words and melody of a popular song). Despite these differences, both descriptions of entextualization crucially point to the process by which signs (of identity, of a song, of a poem, of a scientific law) are hardened over the course of an interaction or a series of interactions and become able to be decontextualized, picked up in new circumstances and recontextualized as a result of their text-like, objectified status.

4. Graphic objectification: writing

Writing is another way of transforming intangible descriptions into object-like entities. Just as nominalization turns a verbal or adjectival representation into a “thing” as a noun, writing converts the discursive or cognitive production of a linguistic representation into a concrete graphic object. Writing is a way of fixing knowledge in place – in a single
physical space on a material medium such as paper – in order to preserve it for future reference or possibly for new generations. It allows assumed knowledge to be placed on a page and collected within a body of written texts. In a scientific community of practice, published texts generally hold information that scientists position as background knowledge. When scientists have collected data and found what are judged to be reliable results, these results get written down because the scientists have a relative amount of certainty that what they claim is true and therefore believe it should be added to the existing body of scientific knowledge. Similarly, students in science classrooms write answers on worksheets that will be graded, and therefore usually inscribe on the page the groups of words in which they have relative certainty, or which they believe hold authority as graphic responses. In this way, the students are beginning to participate in a scientific community of practice through graphic objectification of knowledge.

There is a central focus in American educational systems on literacy and students’ ability to interact with print. Schools devote considerable effort to the use of print resources such as textbooks, lab manuals, and literary reading, and also require the students to objectify their own ideas on paper. Crucially, the students’ graphic objectification becomes the main source of their academic evaluation. The amount of objectified text that students encounter and are required to produce over the course of their education is significant. Thus it is important to consider how it is that students interact with print, how they objectify ideas on paper.

Historically, graphic objectification or writing, at least since Morgan (1963) and Tylor (1958) more than a century ago, has been viewed as a marker of a great cognitive divide, separating primitive from civilized, simple from complex, spontaneous timeless consciousness from linear rational consciousness, charismatic personalistic reasoning from legal rational principles. It has thus become a focus of ideological constructions and an evaluative mechanism for judging societies and indeed social relations more generally.

Derrida (1976) in some ways preserves the oral/literate divide while also turning it on its head. As part of his quest to consider the relationship between speech and writing, he criticizes the view that frames writing as derived from speech, because in terms of their capacity to represent the logos or truth, writing is prior and superior. He argues that this is because writing captures, inscribes and objectifies the truth of what is said, while speech merely depicts it and it disappears as soon as it is uttered. But in order for Derrida to seriously hold such a view, he has to ignore the dynamics of spoken discourse, which is manifestly organized in terms of differences of authority in what is said.

Recently, ethnographers have turned their attention to processes of writing in social contexts and have discovered a far more interesting and complex picture than the dichotomy between the supposedly superiorly literate and the dysfunctionally illiterate. Far from being a great technological and ideological divide separating oral from literate culture, it can be viewed as one resource among many available to actors participating in a communicative activity. Rather than looking at literacy externally as an evaluative criteria to classify societies and types of people, it can be viewed from an inside, actor oriented perspective as a skill individuals make use of in some situations but not in others.

As such, the unit of study is better viewed as what Street (2001), Heath (1983) and others have called Literacy Events. From the perspective of the actor within a communicative activity, researchers can examine what kinds of things one produce over the course of their education is significant. Thus it is important to consider how it is that students interact with print, how they objectify ideas on paper.

In this paper, we adopt an ethnographic perspective of writing as objectification through print. We start with the assumption that talking and writing are things that people do in everyday interactional situations. In the case of middle school science education, they are things that children do in classrooms. As Gilmore and Glatthorn (1982) have pointed out, talking is something that causes children to get in trouble more than anything else. Talking provides opportunities for sociability and popularity but also great humiliation; writing can be more solitary, can require more planning, and is often associated with positively sanctioned classroom behavior. Both talking and writing have serious social consequences for students within the classroom, in their relations with other students as well as with the teacher.

Graphic objectification in learning can vary in terms of function, depending on the cultural context, curriculum unit being implemented, and individual student in question. For many science curriculum materials, student learning is focused on producing correct written responses to questions listed at the end of a textbook chapter that can be verified by locating the answers in preceding texts. In other curriculum materials, more verbal interaction is required because of the focus on student group-centered laboratory activities. Additionally, some students feel more comfortable writing than speaking, while others may feel more comfortable talking with classmates or the teacher than constructing written responses to questions.

We want to look at some of the ways in which things are written and said, and the relations between those two things. We examine these as alternative communicative possibilities occurring at a variety of moments in a classroom context. Wright (this issue-b) discusses students’ literacy practices within the classroom, describing the writing requirements
of CTA, tracing (Bazerman & Prior, 2004) classroom interactions prompted by the curriculum, and outlining features of scientific discourse that the teacher apprentices students into through class activities that include a central written component. Wright discusses the use of charts to guide student observations of phenomena and create durable descriptions of these lab activities, as well as the process of constructing answers to “Think and Write” questions through classroom interaction, the answers to which become objectified scientific ideas or facts. For example, students are apprenticed into “seeing” the redness in rust as significant through the teacher’s evaluative comments about students’ observations of the rusting iron. Throughout the curriculum implementation, writing consistently functions to construct given or background information within this classroom, demonstrating written language’s hardened, objectified epistemic status, conveniently packaged for being built upon in lessons that follow.

5. Objectification of sensory experience

“Even at the most fundamental level, it seems, our expectations shape how we view the world,” declares Martinez-Conde (2007). She is referring to a recent study (Schuler & Bear, 2006) that shows that perception of objects is influenced even in its earliest stages (i.e., in the primary visual cortex) by socialization. Goodwin (1994) further shows how vision, sometimes presumed to be authoritative in creating “objective” accounts of events, is guided by socially constructed categories unique to different communities of practice that see and thus interpret events in different ways. Making meaning of the visual field, or any other perceptual field for that matter, involves categorizing, labeling, and sorting sensory input. Many of these perceptual processes involve the conversion of sensory information into perceived social objects, whether spatial (physical) objects, or events – objects that occur over space and time.

People frequently represent sensory experiences as objects by setting spatial and/or temporal boundaries around them and bracketing them as objects or events (Merleau-Ponty, 1962). As “objects” and actors move through time, and sensory input of these processes and actions is classified as some kind of object or event, we take this as evidence of the objectification process. Indeed, Sperber (2000, p. 3) argues that “[r]epresentations...are themselves objects in the world.” By linguistically representing sensory input as an “object” or an “event,” humans objectify elements of experience, boxing them in spatially and temporally.

Lakoff and Johnson (1980) describe this process in terms of ontological metaphors. They argue,

Understanding our experiences in terms of objects and substances allows us to pick out parts of our experience and treat them as discrete entities or substances of a uniform kind. Once we can identify our experiences as entities or substances, we can refer to them, categorize them, group them, and quantify them—and, by this means, reason about them (Lakoff & Johnson, 1980, p. 25).

We agree that people organize experiences into object-like form, which could be expressed through an ontological metaphor. We further argue, though, that this process is not in essence a metaphorical process but one of objectification, metaphor being one of a number of possibilities for its representation.

There are obviously a variety of types of sensory experience by which humans experience the outside world – visual, haptic, olfactory, sonic, and gustatory, among others. The process of objectifying these kinds of sensory experience can work in a variety of ways. In different societies, one sensory system or another may be favored as a source of objectified knowledge. In other words, sensory information is differentially privileged in its ability to be objectified as an epistemological object. In Sumba, taste is morally objectified as aesthetic judgments of gustatory experience come to represent social interaction (Kuipers, 1991). Among the Kaluli of Papua New Guinea, sonic experiences become objectified through their transformation into bird labels, as sound is the privileged evidence of avian knowledge (Feld, 1982). The Suya people in the Amazon use smell to categorize different clans, thus objectifying clans via olfactory experience (Seeger, 1981). In the objectification of scientists’ experiences, it is often the visual sensory mode which is given precedence (Lynch, 1985). Additionally, the observer’s role is often minimized in representations of scientific facts. In the 19th century, Western observers used technology such as the camera obscura (Crary, 1992) to separate subject and object and supplant individual visual perception with a mechanical device for objective truth. Indeed, Daston and Galison (1992, p. 82) argue that the “ideal of [scientific] objectivity attempts to eliminate the mediating presence of the observer.” Despite the scientific community’s aim of reducing the scientist’s role, the bounded sensory experiences of scientists maintain a necessarily central role in the construction of scientific objects of knowledge.

Wright (this issue-a) proposes the term perceptual objectification to represent a particular orientation to a certain visual or perceptual field and the objects within it, whereby, in science classrooms, “students attune themselves to
looking for the patterned behavior of Nature and by doing so, make reality appear to be held still.” This kind of orientation could be considered one particular way that sensory experience can be objectified in practice. Wright shows how, in processes of perceptual objectification, students change their physical orientation to the objects (e.g., by leaning in toward the center of their lab table when other students point to and comment on the central lab objects); signal a change in agency (e.g., by talking about what the objects are doing rather than what they, the students, are doing); and by referring to the phenomenon at their lab table using single, deictic pronouns that indicate the singular, object-like quality that the perceived objects have taken on for the students.

Another way that the objectification of sensory experience can function within the classroom context is in the construction of events during labs, extending a particular orientation to the objects (perceptual objectification) to representing (e.g., through talk) some thing that happened. For example, in the original example, Philip refers to “that one physical that was a temperature change.” He employs two nouns to represent something that he and his classmates experienced in time and space and then came to understand and represent as an event – a thing that happened. Student labs take on an event-like status through the bounding of students’ sensory experience both spatially and temporally. Labs generally make the most use of visual and haptic sensory modes, and involve the observation of some kind of activity that is transformed into an event, and sometimes a data point in a chart or on a graph. In a sense, the experience must become narrativized, as narratives place boundaries around a story, as a happening in time and space. The process of the objectification of sensory experience thus enables the construction of common perceived objects to which actors such as students and teachers orient themselves socially, about which they talk, and through which they formulate ideas and draw conclusions as participants in a community of practice.

6. Objectification of identities

Another observable manifestation of objectification is the formation of identities – an important and active process among middle school students throughout the U.S. The objectification of identities can be both negative and positive, and often occurs through labeling, or by positioning oneself or others with respect to the social context. Therefore, verbal interaction as well as socially constructed objects play important roles in this process of the objectification of identities.

Hegel argues that self-creation necessarily includes the objectification of one’s own ideas (Löwith, 1964). Much middle school discourse is devoted to differentiating one’s identity from that of others, a sort of discursive self-creation by contrast. Through listening and watching videos of middle school science classrooms, it is hard not to come away with the impression of intense verbal self-fashioning both contrastively and through affiliative gestures (see Bucholtz, 1999, 2004; Eckert, 1989; Eckert & McConnell-Ginet, 1995).

Levi-Strauss’ (1963) discussion of totemism shows how social identities and differentiation between social groups can be created through use of metaphor and association with animals or objects. Similarly, middle school science students often construct their identities through their relation to objects within the classroom. They can do this through the way they use materials like flasks, chemicals, and goggles, to objectify their identities by relating themselves variously to physical objects.

One of the distinctive features of science classrooms is a version of what Knorr-Cetina (1999) calls “object-centered sociality.” Basically, the phrase describes a type of practice in which people group together around a shared object, whether it be a measurement device, Xerox-machine, or some common object-focused activity such as bird watching. Engeström (2005) has used this idea of object-centered sociality to explain why some kinds of software fail and others thrive – he argued that social software that is based around sharing such objects (like photos in FlickrTM) will always be more successful than those that are just meant to create links between people without reference to anything else. “The fallacy,” says Engeström, “is to think that social networks are just made up of people.”

An example of such “object-centered” sociality is Suchman’s (2005) description of the case of Xerox Parc identities in Northern California as they are formed around the development of the 3500 copy machine. She examines how the way in which people define themselves in scientific contexts is in terms of their [predicate-like] relations with an object – “care for,” “interpretation of,” “alienation from,” “talking about” (Suchman, 2005). Similarly, science students often variously relate themselves to lab objects by the ways that they handle, discuss, and even wear these items (e.g., goggles). In this way, students’ identity formation includes connections to objects which are often the locus of the objectification of identity for these students in science class.
Wortham’s (this issue) discussion of the emergence and solidification of one student’s identity within the classroom, through processes of entextualization and interdiscursivity, shows how student identity can be formed over time in science class. He demonstrates how within specific events, and also over time, students’ classroom identities and roles become narrowed down and objectified, and this process then affects structures of participation and, consequently, students’ learning.

7. Conclusions

Objectification – the act of representing a process, action or relation as an object or thing – is not simply a conceptual move, or only a form of social practice, but it is a way of participating in activities. Throughout this issue, the authors explore the ways that students use linguistic objectification, entextualization, writing, objectification of sensory experience, and identity formation as resources for participation in learning activities.

We argue that objectification is a process that occurs over time and is, in reality, itself an objectified act. The study of objectification in context, then, examines not social objects in themselves but processes of the creation of such objects. The types of objectification we have mentioned here, along with potential others, form a group of related processes of objectification that occur in a wide range of social contexts. We wish to explore further how these disparate actions, when examined under this common framework, can be seen to have implications specifically for theories of learning and education. More so, we would like to examine what impact objectification as a mode of participation might have on learning as conceived as participation. We recommend continued research on the intersection of these practices in classrooms and other learning environments. For example, what is the relation between the act of nominalizing and what gets written down? What is the relationship between the construction of classroom events and the formation of identities in the classroom? When students build textual, discursive accounts of scientific knowledge, how does it affect what they write? How they interact?

Beyond the participation structures involving various ethnographically observable manifestations of objectification, we suggest a deeper examination of the pedagogical importance of objectification. Because objectification creates a type of “black box” (Latour & Woolgar, 1986), it is important in education to investigate what is inside. As children are learning, they use these various processes, and potential others, to objectify their ideas, their knowledge, and their actions, in an effort to build these experiences into new situations, or recontextualize the objectified processes, actions, or relations they have built in the classroom.

The educational notion of “transfer” could be considered to describe such processes of recontextualization of these interactionally constituted boxes. Lobato (2006) recently called for a deeper investigation into “transfer mechanisms,” urging researchers to examine situated practices in classrooms and describe how it is that knowledge becomes boxed up for recontextualization in other classroom activities. The processes described here certainly constitute such modes of box construction, or ways of objectifying knowledge and other elements of social interaction within the classroom, and could contribute significantly to current reformulations of the notion of “transfer.”

We suggest a further exploration of the contents of these objectified boxes of knowledge, how they may contribute to identifying elements of “transfer” within educational practices, and what impact the construction and recontextualization of such objects has on student achievement in schools. For example, if learning to “talk science” requires grammatical skills such as nominalization, would it be useful for teachers to encourage this in the students’ work in appropriate contexts? If learning to act like a scientist means developing an “object-centered sociality,” would it make sense for teachers to encourage classroom roles that position the students in relation to relevant phenomena? If learning science involves practice in reasoning from evidence, should curriculum materials provide opportunities for the creation of verbal texts, as well as require students to inscribe answers graphically?

Objectification is not inherently bad or good: it happens, and it appears to be a fairly active process in science classrooms. It shows up on paper, in speech, and in interaction. It shows up in Philip’s nominalization of an adjective in order to represent a prior classroom event, in Gloria’s reframing of her own speech to communicate to her peers “what” she is saying, and in all four students’ shared orientation toward the epistemological objects being addressed by the curriculum unit – physical and chemical changes. The students’ acts of objectification have implications for their

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3 It should be noted that objectification should not be seen as equivalent to learning but rather as a mode of participation which can be related to learning.
participation in the current activity, as Gloria’s question works to frame the conversation and Philip’s nominal carries authority as a written response. Objectification often functions as a way for actors to semiotically privilege knowledge, by placing ideas as background assumptions, by fixing them on paper for later consultation, by removing whole chunks of discourse from context for use in other settings, by bounding events and labeling them for future reference, and by characterizing the knower in relation to relevant scientific phenomena.

We hope to privilege objectification as a way of looking at social practice. The papers in this issue take some promising first steps in this direction.

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