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Heeding Wittgenstein on “Understanding” and “Meaning”: A Pragmatist and Concrete Human Psychological Approach in/for Education

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Abstract

Over 60 years ago, the influential language philosopher L. Wittgenstein suggested that there is no need to use "understanding" and "meaning" to understand how language works and, in fact, that the two theoretical terms are part of a primitive idea. Today, both remain two of the most frequently used terms in education. The purpose of this paper is to stimulate a discussion about abandoning these terms from the theoretical discourse of education in the way these are commonly used. Case materials from the research literature chosen from a large database on knowing and learning in science are used to exemplify the approach that does not require either concept. Implications are drawn for education research and practice.

Das Verstehen, die Meinung, fällt aus unserer Betrachtung heraus [Understanding, meaning, drops from our considerations]. (Wittgenstein, 2000, p. Ts-213, 1r)

We know the general law: [speech =] first a means of acting on the other, then on oneself. . . . It is necessary to explain [psychological functions] not on the basis of

internal organic relations (regulation), but in external terms—based on the fact that man controls his brain activity *from without* through stimuli. (Vygotskij, 1929/2005b, pp. 1021, 1023–1024)

“Understanding” and “meaning” are used in educational discourses to refer to immaterial (meta-physical) things (e.g., “concepts” or conceptions [mental structures]) inherently inaccessible to investigators, teachers, and students alike. These words are part of the 20th century myths of linguists that the problem of language is how it relates to the world (Harris, 2009). The purpose of this paper is to stimulate a discussion about abandoning from the theoretical discourse of education any notion that privatizes experience and learning by attributing these to “understanding” and “meaning” that are to be found somewhere in the individual or in non-physical—i.e., meta-physical—worlds of ideas. The purpose, therefore, is to develop Vygotsky’s agenda of a *concrete* human psychology (Vygotskij, 1929/2005b).

Since the publication of *Talking Science* (Lemke, 1990), language in science and mathematics classrooms has received ever-increasing attention (e.g., Bruna & Gomez, 2009; Roth, 2005). Associated with this attention are interests in such concepts as “understanding,” which large-scale reviews of the literature say is improved, and “meaning,” which is made, agreed upon, or shared when students have opportunities to talk science (Bennett, Hogarth, Lubben, Campbell, & Robinson, 2010). Indeed, “understanding” and “meaning” are two of the most frequently used concepts in education (Roth, 2013b), the second term appearing 280 times in *Talking Science* alone. However, as the first introductory quotation shows, both terms are to be dropped from pragmatist considerations of language.

The second introductory quotation suggests that psychological functions are not merely *internal* things but are based on the fact that human beings use external signs to stimulate and act upon their brains; genetically, they exist as societal relations first before these are subsequently reflected in the person.¹ The most important (material) signs are of linguistic nature (Vygotskij, 1934/2005). We experience these in the form of sound-words or ink/electronic-trace-words. If psychological functions are *external*, as Vygotsky suggests, then there is no need for theoretical concepts that presuppose phenomena to be explained by constructs referring to something inside the brain or to metaphysical entities.² This is further accentuated by a statement in regards to what often is taken to be private experience: that “to read one’s own notes—to write for oneself—means to relate to oneself as to another. Etc. etc. *This is a general law for all higher psychological functions*” (Vygotskij, 1929/2005b, p. 1022,

¹ The “inner reflection” should not be read that we then have a Piagetian subject. Instead, as Mikhailov (2001) reading Vygotsky on the issue of the outside/inside distinction suggests, mind is possible only on the *dynamic interface* between self (inside) and other (i.e., non-self, nature, outside) “*where there is a continual coming and going of one into the other*” (p. 20, original emphasis). This “interface [is] defined not by the fact of their difference . . . but by the single process of their mutual generation and mutual determination” (pp. 20–21).

² Any consideration of the “meaning” of a word other than its *use* is metaphysical (Wittgenstein, 1953/1997). “What *we* [pragmatists] do is to bring words from their metaphysical to their everyday *use*” (p. 48, emphasis added). Thus, saying “red exists” is a “metaphysical statement about red” (p. 28).

original emphasis, underline added). Thus, the origin of pointing gestures—i.e., of indexical signs—is not the intention of the baby to get something or to orient others to some objects, but the origin are others, who act on first random movements of children in consistent ways. Is there a need to rid our conceptual language of “understanding” and “meaning”? The answer is yes if we are interested in ridding our theories of Platonism (Nöth, 1990) and of a “primitive idea of the way in which language works” (Wittgenstein, 1953/1997, p. 3). Wittgenstein orients us to consider the *use* of the word as its meaning (Harris, 1988).³ A scientific discipline of education would want to rid its theoretical language of such terms if it is interested in abandoning solipsistic notions of what it is to participate in fields of knowing and how we learn not only any form of language (discourse) but also how we know our way around the world more generally.

Although Wittgenstein suggests that “understanding” and “meaning” do not have a place in pragmatic considerations of language, even those education scholars most familiar with his work and who most explicitly invoke the philosopher continue to use the terms extensively (e.g., Wickman, 2008; Wickman & Östman, 2002). Even such scholars suggest, for example, that students extend a word like “voltage” “to issues of, for example, the *meaning of voltage*” (Hamza & Wickman, 2013, p. 117, emphasis added). Usage of this kind implies that there is something other than the use of the term “voltage,” namely the “meaning of language,” that is pointed to or constructed by the user. These scholars also suggest that good instruction “further[s] student’s [sic] understanding of the science topic” (p. 134).

The limitations of these concepts are pointed out in the discussions of a Dostoevsky text, which describes how in a group of six drunken workers the same word was said six times, but each times doing something else, such as contemptuously rejecting, doubting, outraging, and reprimanding (Vygotskij, 1934/2005). These things are done in and completely determined by “the immediate social situation of the conversation” (Vološinov, 1930, p. 106). What is being done is independent of the dictionary sense (“meaning”) of the word: its dictionary sense is completely irrelevant to what is happening in the episode that Dostoevsky describes. But the rules according to which the word is used are not given but are and have to be invented every time anew in every communicative exchange (Davidson, 1986; Harris, 1988). For Vygotskij (2005), (material) signs do not point to metaphysical entities but are (material) signs used to operate upon (influence, relate to) others before these are used to operate on (influence, relate to) oneself. The use value (Rus. *značenie*) of words rather than some “word meaning [*značenie slova*]” that people *make* above and beyond actual use (i.e., metaphysically). In the same way, ordering someone else to make some movement (e.g., someone saying “do shift pixel”) and doing the action after ordering oneself (planning, intending) are but variants of the same language-game (Wittgenstein, 1953/1997, p. 162 [§630]), of the same integrated whole of world and language (Harris, 2009). Concrete material, external signs and how we use them are at the heart of how we come to behave in characteristically human ways and, therefore,

³ *Use* focuses on the value [Rus. *značenie*] of words in exchanges, what a word *does* to another person (Vološinov, 1930; Vygotskij, 1934/2005). Constructivists instead that is different from use: “meanings . . . must under all circumstances be constructed *in the heads* of the language user” (von Glasersfeld, 1989, p. 444). According to Vygotsky (1929/2005a), empirical psychology is “permeated by metaphysical idealism” (p. 122).

are at the heart of Vygotsky’s program of establishing a *concrete* human psychology (Vygotskij, 1929/2005b).

“Understanding” and “Meaning” in the Science Education Literature

“Understanding” and “meaning” are theoretical concepts frequently used, but perhaps unnecessary concepts in science education. These tend to be employed to point to phenomena at best indirectly available and, at worst, are entities from a meta-physical realm to which no human being ever would have access.⁴ In this section, analyses are provided of the ways in which these concepts are used. I randomly selected two articles from volume 97 (2013) of *Science Education*. These texts are analyzed as examples of a *discourse* reflective of a community of practice—the articles have been vetted in the peer-review process and are read by hundreds if not thousands of scholars around the world—rather than of the individual authors that appear on the byline.

Case 1—Understanding

The *application* remains a criterion of understanding. (Wittgenstein, 1953/1997, p. 58 [§146], emphasis added)

The first article was designed to exhibit the differences between what students say about scientific inquiry versus what they do when conducting an inquiry (Salter & Atkins, 2013). In total, there are 88 instances of the stem “understand” (“meaning” is not deployed). The text quotes research participants, who make statements such as “I think science is basically everything . . . Science has little difference compared to religion or philosophy, those too are a science but less experimental and more thought-process based” and “In science one learns why something happens by doing different experiments and research. An experiment has a certain method and steps one has to follow” (Salter & Atkins, 2014, p. 2). They then state as the primary rationale for student engagement “in learning about the nature of science (NOS) is that such *understandings* allow them to successfully engage in scientific inquiry” (p. 2, emphasis added). That is, in the stretch of talk excerpted from the conversation that the researchers had with the elementary education undergraduates in their study *reflects* “an understanding.” The authors wonder whether the student articulating the second quotation above “would adhere to a rigid scientific method”? The purpose of that paper is to explore whether “what [a student] says about NOS corresponds to what she does when she engages in

⁴ This is the essence of Plato’s cave allegory.

scientific activity?” (p. 2). Wittgenstein (1953/1997) points out the general supposition that “understanding is a state *from which* springs correct application” (p. 58 [§146]). He then suggests, as apparent from the introductory quotation to this section that in *any* case application—talk or practical action—remains a criterion of “understanding.” We therefore do not require the concept and the hidden (mental) phenomena it denotes, for in any case researchers draw on observable behavior.

The text compares what students actually do and what they say about various NOS themes. It uses excerpts from interviews that are compared with observations. For example,

- Int.2 Leslie: Are there particular steps that someone has to go through to have a valid experiment?
- Int.3 Briana: Um, I’m trying to think back to what we did in class. We always had—see like with the box theater we had predictions first of what we thought would happen and then, um, why we thought that would happen. Then we would do the observation or the experiment and see if our thoughts were right or not. And then, from there change it or tweak it until you get what you want.
- Int.4 Leslie: And you think that’s pretty standard for all of science? That that’s when you’re doing experiments that it’s having a prediction of what I’m going to see and testing it out?

(Salter & Atkins, 2014, p. 30)

From a pragmatic perspective, as from the cultural-historical activity theoretic perspective outlined below, Briana is actually participating in two forms of language-game, two forms of cultural-historical activities. In one, she talks to an interviewer *about* doing experiments. The talk not only constitutes the topic but the very relation with the interviewer. In the other context where Briana was observed, she is doing science methods class generally and doing the required experiments specifically. From the perspective of Wittgenstein (1953/1997), there are two language-games at work: one in the interview and the other in inquiry settings. In the way there are differences between playing checkers and playing chess—despite the common historical roots—the rules, moves, goals, and figures are different, associated with different forms of language people use *while* playing and in talking *about* their or someone else’s play. Cultural-historical activity theorists (Leont’ev, 1983) and practice theorists (e.g., Bourdieu, 1980) tend to take the same position and anticipate very different orientations, concerns, and forms of talk to be prevalent in each situation. We therefore *ought not* anticipate much of a relation between what people say they do and what they do. The feel of the practical game, as Bourdieu (1980) suggests, is very different from talk about the game, which he qualifies as *illusio*. That is, what scholars frequently invoke as “understanding,” the content of what their participants say *about* what they do is actually an illusion.

In this instance, the statement⁵ “Are there particular steps that someone has to go through to have a valid experiment?” presupposes its intelligibility. It is not just a statement resonating in the mouth of Leslie, it is simultaneously a statement in the ears of Briana. The statement therefore does not just belong to Leslie, it is a statement that language enabled and, therefore, it is a statement that is possible for speakers of that language generally (Vološinov, 1930). A word, sign, always is a possibility for two and is “impossible for one” (Vygotskij, 1934/2005, p. 1018); every present uttered word responds and reacts with its every fiber . . . to the unspoken words of another person” (Bakhtin, 1981, p. 197). The same is to be said about the next turn at talk, where the sequential positions of the same two participants has changed, that is, the roles as speaker/recipient that they play. Again, the statement presupposes its own intelligibility, and the fact that Leslie responds to it and follows up on its content signals that what has been said was indeed intelligible.

Rather than focusing on individuals, scholars concerned with the pragmatics of language focus on relations in the societal sphere.⁶ Here, rather than having Leslie’s questions confronted with Briana’s replies, the focus becomes the nature of the *social*, inherently *joint* action that is accomplished at the level of the *conversation*. As explicit in idiomatic expressions such as “It takes two to tango” or technical expressions such as “Pas de Deux” (a ballet form, literally “step of two”), many phenomena are collective. The question then becomes, “What are *they* doing?” The minimal unit of analysis is a societal one and statements can no longer be attributed to the individual, as any intelligible statement belongs to both (Derrida, 1996; Vološinov, 1930); statements are tokens in dialogical exchange relationships “of agreement/disagreement, affirmation/supplementation, question/answer, etc.” (Bakhtin, 1984, p. 188). It always takes two, persons or voices, to accomplish each. Should there be an instance of an unintelligible statement, the actors themselves make this available to each other and initiate *repairs*.

Once we approach such exchanges between Leslie and Briana as *joint* moves in language-games—the irreducible ensemble of language-in-use and the social-material setting—then there no longer is a question of the veracity of a statement. Any statement is subject to the rules of the game, including the question of what constitutes appropriate contributions, and no longer is subject to individual subjectivity. From all the possibilities that language offers for participating in the interview game that Leslie proposes, Briana is realizing some but not others; her peers also realize some possibilities, which may be the same or different. Once we take the exchange as a set of moves in a particular language-game, Leslie and Briana can be said to succeed in playing the language-game (which includes not only language, but, especially in interview situations, also the conversational moves that constitute the relation itself). The relation exists in and as of the talk, making the content of the talk secondary. For if there were no relation, there would not be intelligible to talk about any content. Precisely

⁵ I use the term “statement” to translate the Russian *vyskazyvanie* rather than the frequently used utterance, because, as has been suggested (e.g., Roth, 2013a), Bakhtin (e.g., 1981) uses it when writing about literature rather than about the spoken word that the term utterance implies.

⁶ In the Anglo-Saxon literature, the adjective *social* dominates. However, Vygotsky sometimes and Leont’ev almost exclusively uses the Russian adjective *obščestvennyj*, societal, which, in German Critical Psychology (Kritische Psychologie) is taken up in the equivalent adjective *gesellschaftlich*.

because each statement simultaneously is in the mouth of the speaker and in the ear of the recipient, it does not belong to one or the other (Vološinov, 1930; Vygotskij, 1934/2005). It is not Briana's private "understanding" that matters; if anything, the statements are characterized by their general possibility of being intelligible. What matters are the ways in which we employ the means of language, which always happens in the social arena and, therefore, publicly, concretely and in the relation with others.

Case 2—Meaning

[N]o concept supplies the meaning of speech, not even the concept of concept, for speech is not the meaning of meaning. (Lacan, 2006, p. 291)

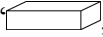
The second article describes how science curriculum emerges from the wonderings of kindergarten children (Siry & Max, 2013). In the text, the stems "meaning" and "understanding" are mobilized 15 and 7 times, respectively. This article uses two ways of deploying "meaning." One invokes the "meaning" students are said to make, the other one concern "meanings" for the reader of the article. Thus, pertaining to the latter, the authors suggest that they articulate theoretical underpinnings of their work and then "surround these in meaning in the sections that follow with an empirical analysis of a unit that was co-constructed by children and their teachers" (Siry & Max, 2013, p. 879). In one example taken from this study, the question concerns an observation the class of children had made as the water of an aquarium became colored when crayons were placed in the water. Some time later, one of the student teachers (Ms. Delia) and several children participate in an exchange in the context of a larger group. The study offers the following transcription:

Excerpt F: Large Group Discussion

- 01 Ms. Delia why (.) why does the big one melt
 02 and the small
 03 one does not↑
 04 Kevin no the small one doe:::s melt
 05 Ms. Delia why does the thick one not melt then↑
 06 Kevin why↑ (.)
 07 because they are not the same
 08 Ms. Delia kevin just said that the big ones don't melt
 09 because they are not the same
 10 Ann yes (.) different things

- 11 different manners
 12 Ms. Delia different↑
 13 Ann different manners for melting (.) yes

(Siry & Max, 2013, p. 895)

Analysts frequently point to individual words and suggest that students “make meaning” with respect to it. Siry and Max (2013) suggest science to be a cultural enactment in which a system, consisting “of symbols and *meanings*” (p. 880, emphasis added), and practice come to interplay. Wittgenstein asked in this respect, acknowledging that although “slab” may point to a material object “,” what would be “the,” “for,” or “are” in the children’s and Ms. Delia’s talk pointing to? Lacan (2006), who, as the opening quotation suggests that no concept could supply the meaning of speech, uses the actions of lying or using metaphor to argue for the uselessness of “meaning.” As to what happened in the present excerpt, the text notes: “Children created *shared meaning* around these experiments, which Mia and the children had together carried out as they observed the unfolding experiment. Ms. Delia was open to this type of negotiation and collaboration” (Siry & Max, 2013, p. 896, emphasis added). The text does not specify *what* that meaning was or *where* to see it in the transcription. Because “meaning” can be made in different situations, the term is used to invoke something not actually present—consistent with Lacan’s (2006) suggestion that meaning is *never* achievable, always retreats when one attempts to grasp it. If it were to be seen in the transcription, we would actually not require the term, as it would suffice that children use the same or similar aspects of the language-game in their contribution to this stretch of classroom talk. For example, the text might have stated: “The children used the same language for talking about the experiments. . . .” However, before anything can be exchanged, the language is used to constitute the relation between teacher and student; and what they are doing is playing a language-game that invokes another part of the setting, when the children were messing about with crayons and talking about what they were seeing (coloring of the water). That is, there are different parts to the overall language-game of doing science lessons, one part concerned with doing messing about (inquiry) and the other concerned with talking about what happened.

In the excerpt, the children are describing and explaining observations they have made. The situation therefore can be thought of as a special form of show-and-tell that is so popular with smaller children. Indeed, “showing or telling what one sees” or has seen “is one of the most fundamental language games” (Wittgenstein, 1968, p. 283). Much of what we do in everyday life, “what we in everyday life call using language presupposes this game” (p. 283). We therefore do not require “meaning” or “understanding” for describing or explaining what is happening in the excerpt. Ms. Delia and the children are playing a game that has great family resemblance with other (show-and-tell) games that children of this age and into elementary school play on a daily basis (e.g., Andree, Wickman, & Lager-Nyqvist, 2013). Wittgenstein (1953/1997) names what is happening in this situation a language-game, specifically one in which joint action is identified by the turn pairs “reporting an event—speculating about the event” (p. 11). This part of the conversation turns out to be about something that the children

have previously observed, and which is reported here in different observation sentences (“the big one melts,” “the small one does not [melt],” “the small one does melt”). There are therefore different versions reported, and part of the exchange is concerned with identifying which of the objects actually “melted.” The other part of the game is to pair the reported event with speculations (hypotheses) about why some and not others melted. The games people play have their rules—even rule breaking is part of it (Garfinkel 2002)—and the one played in the excerpt is no different. Above all, it is a game played in and constitutive of school science. An integral part of school games is to have children learn the rules by playing the game—which, at times, involves the ordering and orderly voice of the teacher reminding of and insisting on the rules (e.g., orderly turn taking when intending to speak).

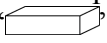
Returning to the opening of the excerpt, the unsuspecting analyst might claim that Ms. Delia asked a question. But it turns out that at the level of the conversation—i.e., viewing the talk as a form of social, joint action—the pairs of turn lines 01–03 | line 04 actually constitute a claim (“the big one melts”) and a counter-claim (“the small one melts”). In the next turn sequence, there are two statements, one about the small crayon melting and the second one about the thick one not melting. The second statement also can be heard as a question because of the interrogative “why” at its beginning. This possibility is actually realized concretely with the next statement, which completes a query | reply pair (“why . . .?” | “because . . .”). Do we require “meaning” as a theoretical concept for describing and explaining what is happening here? With Wittgenstein I respond, “no, we do not need this term.” First, for the game to be intelligible at all, together with its content, whatever they do and say already has to be shared. What then is happening? In any case, it is not the “creation” of shared meaning; what is required is the possibility of acting in a familiar world, or acting so to make the world familiar in the same way that we walk around a city during our first visit to become familiar with it. No concept can supply meaning; and no speech could supply the meaning of meaning (Lacan, 2006). Instead, the children and Ms. Delia are playing at this game, and if something does not work, such as when a statement does not seem to correctly describe what has been observed, they produce a revision in an orderly and order-constitutive turn sequence. The language-game played is about producing a description and an explanation of what happened when crayons were placed in the aquarium. Anything that can be learned is out in the open, ready for the taking. In fact, taking up on the quotation that opens this text, it is the observed relation itself that is the origin of any higher psychological function (Vygotskij, 1929/2005b), which, in the context of classrooms, may pertain to scientific argumentation (Kim & Roth, in press). The children participate in this language-game, and in so doing, become better at it. They may even emulate Ms. Delia and, thereby, come to participate in this game in new and different ways.

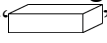
A Pragmatist Approach to Language-in-Use

As the text-opening quotation states, “understanding” and “meaning” are not required in describing and explaining language-in-use. In any case, as the second quotation suggests, speech first is a means of acting upon others. Signs are material and actions upon others are public—making recourse to individual (private) “understanding” and “meaning” superfluous.

In this section, I first sketch a theory of language-in-use in pragmatist philosophy and then provide an example of language-in-use from a world-leading scientific research laboratory.

Theory of Language in Pragmatist Philosophy

The term “meaning” fundamentally is employed in referential ways: “Every word has a meaning [*Bedeutung*]. This meaning is correlated with the word. It is the object for which the word stands” (Wittgenstein, 1953/1997, p. 2).⁷ Wittgenstein uses the example of the work of a builder and his helper, where the latter brings a material object “” when the former makes the sound /slæb/, which speakers of English hear as an instance of the sound-word “slab.” (Dutch speakers might hear it as /sla:p/, “slaap” sleep.) The two are playing a *language-game* that includes different material objects for building a house and sounds that lead to the supply of a specific type of these. This term invokes the practical activities people engage in together with the language they use. Wittgenstein likens practical activity together with its associated language to the games children play when they learn their mother tongue. Even more explicitly, while discussing the situation in which a person A shows a person B some color patterns, he proposes that these color patterns are part of the language-game (even though they do not belong to a set of objects collecting words) in the same way that any member of the set of words also can become topic of talk (§16). The term underscores that speaking (i.e., the speaking of a language) always is part of a (productive) activity, one of the many society-specific forms of life (A. A. Leont’ev, 1969; Wittgenstein, 1953/1997). Wittgenstein notes that children become familiar with this language-game when they “are brought up to perform *these* actions, to use *these* words as they do so, and react in *this* way to the words of others” (Wittgenstein, 1953/1997, p. 4). Other types of language-games involve persons observing “certain regular events/processes—e.g., the reactions of different metals with acids” and subsequently making “predictions about the reactions that will occur in certain cases” (p. 162 [§630]). That is, he describes what the children and Ms. Delia do as a language-game; and, because in the game everything is on the table, he has no need to seek recourse to hidden “meanings” and “understandings.”

With the introduction of the term *language-game* [Ger. *Sprachspiel*], Wittgenstein actually erases the distinction between knowing our ways around the world generally and knowing a language appropriate for the specific situations. This is so because knowing the language of building and acting appropriately in the common activity of building a house—e.g., bringing the object “” after the sound /slæb/—has become the same. Rather than focusing on language, Wittgenstein suggests taking the language-game as the primary phenomenon (Wittgenstein, 1953/1997, p. 167 [§656]). This is equivalent to the choice of taking the collective, motive-oriented, productive human activity as the fundamental unit of analysis in cultural-historical activity theory (A. N. Leont’ev, 1983). Any act of speech always integrates two levels, speech activity and the broader societal activity (e.g., farming, manufacturing,

⁷ The German term “*Bedeutung*” also translates as (in many contexts does so much better) “signification,” because the German does not have an equivalent for “meaning.” The verb *meinen* is used like “to mean,” but the noun *Meinung* is used more like “opinion.”

schooling, or doing science) in and as part of which speech activity takes place. The two levels presuppose each other (A. A. Leont'ev, 1969), such as language and the associated activity that Wittgenstein describes. The focus on speech acts and speech activity redirects our attention from “meaning” and “understanding” to what people do and how they achieve doing it in the concrete settings of their everyday, mundane lives.

The number of language-games in a society is countless, and new language-games are continuously created (Wittgenstein, 1953/1997). Between the different language-games at play, there are “family resemblances [*Familienähnlichkeiten*].” Just as there are similarities and differences between the members of the same family, so are there similarities and differences between what we properly talk about as games (leisure) or those activities associated with specific forms of language generally talked about as language-games. We must not just compare the words and how these are assembled into statements but the associated activities, the specific instruments and objects involved, the division of labor, the particular public arenas in which the game takes place, and the specific (often unstated) rules at work. (Most people, and especially young children, speak without knowing anything about or much formal grammar at all.)

One of the reasons why the term “meaning” is not of much use is its failure to take into account what actually happens or what people are doing in and with speaking. For example, the statement “five slabs” may be an assertion (falling intonation), going together with a finger pointing to five slabs on the floor; it can be part of a query, where the statement *five* (rising intonation) slabs goes together with finger pointing to six slabs, allowing us to hear it as a question about the number of slabs. It can be part of a query concerning the nature (rather than number) of the objects pointed to, such as when the statement “five *slabs* (rising intonation)” is produced together with a finger gesture pointing to five cubes. It can also be part of an exchange in which “five *slabs* (increased speech volume, falling intonation)” is followed by a helper bringing five slabs, thereby realizing an order | compliance sequence. Not only intonation is important, but also the facial gesture, which, depending on the situation in which any of the preceding possibilities plays itself out might lead us to hear a criticism, irony, mockery, serious description, or accusation. Saying that the expression “five slabs” “means” that there are five objects identified as slabs is only the lower (in fact, the lowest) limit of signification. The upper limit has been variously denoted as theme (Rus. *tema*) (Vološinov, 1930) or word signification (*značenie slova*) (Vygotskij, 1934/2005).⁸

In Wittgenstein’s example, the builder and helper produce a rudimentary form of conversation. In an incisive analysis of the requirements for two persons to have a conversation, Davidson (1986) concludes that they have to have the same language, which is another way of saying that they have “to converge on passing theories, degree or relative frequency of convergence,” which “would then be a measure of similarity of language” (p. 445). But two people could then not decide on the concept of a language, for the (momentary) passing theories could be of any kind other than linguistic. This troubles the very idea of a language: “It is easy to see that the idea of ‘knowing’ a language will be in the same trouble,

⁸ I propose reading and hearing *značenie* as the English equivalent of (use, exchange) value rather than as “meaning.”

as will be the project of characterizing the *abilities or capacities a person must have* if he commands a language” (p. 445, emphasis added). This is so because the definition of linguistic ability becomes circular. The philosopher suggests that linguistic ability allows persons to converge on a passing theory appropriate for the situation in which they find themselves. This then leads to a situation where any theoretical boundary is erased “between knowing a language and knowing our way around in the world more generally” (p. 446). This is precisely what Wittgenstein (1953/1997) talks about as the “halo” of thought. The essence of this halo, its logic, is an order that is common to the world and (verbal) thought; and it must exist prior to all experience. Those simplest language-games we play are not developmentally earlier versions of the games we play at some later point. Those language-games are in fact *constitutive* of all others we come to ever play, including that of science (Husserl, 1976). The very distinction of the use of “force” in scientific discourse and vernacular is based on the basic language-games we played before any science cultural-historically has existed and before in individual development continues to exist. Importantly, Davidson (1986) suggests that there is no more change of teaching a language than there is to teaching how to create a theory when there are data that the old theory or theories no longer can account for.

Because language-in-use first and foremost is a public event, a way of affecting an Other (Vygotskij, 1929/2005b), we actually need to see a statement paired with its corresponding action or statement that the recipient produces to be able to evaluate the *societal* action that has occurred—such as when “Does it rain?” comes to be paired with the affirmative “Yes” (Wittgenstein, 1953/1997). Other examples of pairs are language-games such as ordering | following or describing an object | producing the object. Of interest to educators will be the fact that Wittgenstein lists among the language-games that involve pairs such as the reporting of an event | speculating about the event, posing hypotheses | testing hypotheses, posing and testing hypothesis | presenting the results of an experiments by means of tables and diagrams. That is, when investigating what students do in a science laboratory, for example, whether the curriculum is organized in the traditional confirmatory way or in the more open sense in which the articles analyzed here do (Salter & Atkins, 2013; Siry & Max, 2013), can be entirely taken as the kind of games people play (science students and their teachers, science education researchers and their participants), where everything needed is available in public and accessible to every other member to the setting.

The Language-Games Scientists Play

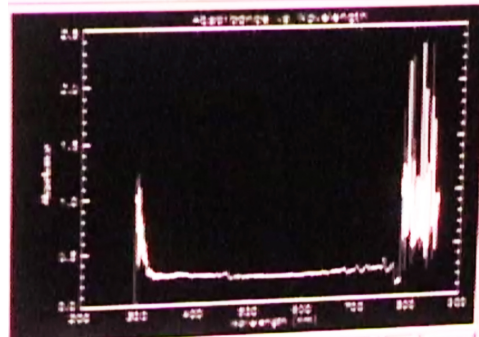
Can we do analyses of conversations in science education, for example, those that are recorded in the laboratory, without mobilizing “understanding” and “meaning”? To do so, we focus on language-games: What are the kinds of games students or scientists play? Once we do so, everything is available to everyone else, including whether some action or speech conforms or not with the rules at hand and including the articulation of the rules themselves (think of any match in a competitive game). Relevant to science and science education, weighing objects is one of the language-games Wittgenstein describes, involving balances and materials (Wittgenstein, 1968). Sometimes the weight of some material changes over

time, such as iron in the presence of mercury, whereas at other times the weight changes—e.g., cheese in the grocery store—even though other aspects, such as size and calories, may not change. The verbal descriptions may change, because in the former instance the descriptions and explanations involve no change in what the balance shows whereas in other situations there are changes to be described and explained. That is, we do not require “meaning” and “understanding” to describe and theorize what happens in science when participants make use of a balance or scale and objects to be weighed. To provide an example of how such analyses might unfold, consider the following example from the language-game glossed by scientists as “collecting data,” which is part of the overall game of the “scientific production of knowledge.” In the following fragment, three scientists are involved in collecting data that are part of an article published some time later in a scientific journal for experimental biology. The language-game played involves all the equipment in use, including the high-powered microscope, the sample (on a microscopic slide) placed in it, the displays of the microscopic slide on the computer monitor, and, next to it on the large monitor, a changing display of graphs. Also integral to this game is the unfolding talk, the sounds, and the pauses. The three protagonists, all members of the scientific research team, are Craig, Theo, and Michael.

In the first part, the game is about making the light fall through the photoreceptor cell. Following and in response to the “quick,” we hear a shutter in the instrumentation close (turn 02), and, then, a little while later, another one open. At that point, Craig says “scan” (turn 05). In this part of the fragment, readiness to collect a recording, preparation of the equipment for a recording, and request for a recording to be done ensue each other. The second part of the game then concerns finding whether there is something in the graph and, therefore, whether whatever had been seen under the microscope was a suitable photoreceptor for the purposes of this research. Thus, over 5 seconds later, the graph display changes, and there is a question | answer sequence concerning the contents of the display (turns 08 | 10). Other pointing / naming games are observable in turn 20, where the cursor points to part of the spectrum while Theo says “perhaps there’s something” and in turn 27, where the statement “this looked like we had a you-vee there” invokes the situation in turn 12, where Michael had talked about “something in the UV.” After some more pausing, there is a query/statement | confirmation pair that specifies the presence of “something” in the UV part of the spectrum displayed (turns 12 | 13). The third part of the game is concerned with getting that searched-for UV signal to reveal itself better. Part of this game are further instructing | following exchanges, such as when the statement “do a shift pixel” is followed by changes on the monitor that all those present know to be the results of shifting the two graphs of which the current display is the difference by one pixel at a time to seek the right alignment between the two (turns 16–17). The same type of exchange occurs again in the pairing of the statements “go left again” and “or right” with changes in the graph associated with the shifting of the graphs underlying the displays.

Fragment

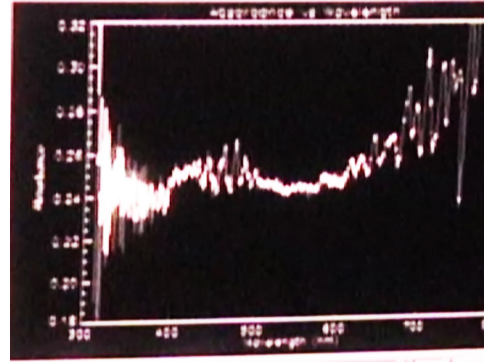
- 01 T: quick.
 02 ((clack))
 03 (0.82)
 04 ((clack))
 05 (0.42)
 06 C: scan.
 07 (5.58)
 → 08 M: ((*))<<pp>what we=re having?>
 08 (0.36)
 10 T: tha thats the (broke?)
 11 (3.71)
 → 12 M: ((*)) is there something in the
 you=vee?=
 13 C: =its a you=vee, yea.
 14 T: yea.
 15 (0.65)
 16 C: do a shshshIFt=er PIXel; ((T changes in
 the way the graph presents itself))
 17 (6.59)



18 T: ((*)) <<pp>very hard.> ((*slight changes in graph*))

19 (6.61)

20 T: <<pp>perhaps there=s something below
((*moves cursor to a slight peak left of the ringing*))



21 (1.05)

22 C: <<f>BUT> (0.27) well go left again

23 T: <<pp>hmhm>

24 (3.82)

25 C: or right, or whatever? yea

26 (2.60)

27 this looked like we had a you=vee peak there.

28 M: uh hn

In describing what the scientists do, how and why they do it, there is no need to seek recourse to “meaning” or “understanding.” The language-game at play is of the kind that Wittgenstein (1953/1997) involving the builder and his helper. In the present situation, “scan” is followed by an action that others perceive to be taking a scan, where the light falls through the photoreceptor, distinct from another action that comes after “ref[erence],” when the light from the source goes through the microscopic slide but next to the visible shape denoted as “photoreceptor.” in a similar way, “do a shift pixel” is followed by a specific action that changes the display in ways never identical between different data but nevertheless recognizable and repeatable with a given pair of recordings. Yet other parts of the language-game in play concern pointing to, naming, and even outlining objects and their parts (e.g., Wittgenstein, 1953/1997, p. 169 [§669]). Those present are part of a language-game, with which they have become familiar while participating in it. As the ethnographic work in the science laboratory showed, newcomers become familiar with it rather than being taught in some explicit ways, in part because they are playing the different roles involved, for example, operating the computer or moving for objects on the slights, aligning them with the crosshair, opening and closing the shutters, and so on.

In this example, the language-in-use, the words it is composed of, have their place within the laboratory context as a whole, and within the larger game named to be “production of

scientific knowledge.” The language is not so much about something in a metaphysical netherworld than it is for accomplishing a particular move in the overall language-game “the production of scientific knowledge.” Even when these scientists describe the methods or the results in the scientific research article that results from this work, every statement, every non-linguistic inscription, can be described and explained as a move in a battle, to be described by means of strategy, ambush, and escape routes (Bastide, 1985). It is not the “meaning” or “understanding” of a statement that matters but its role as a move in the game.

In the excerpt from the laboratory, we find the term “UV [peak].” Scholars concerned with concepts tend to focus on the “meaning” of such words and the degree to which conversation participants “understand” the term. But we do not actually require these theoretical resources. Instead, the ethnographer observes that the first appearance of the sound /ju: vi:/ occurs together with the appearance of a graph (turn 12). Later, the chief scientist talks about the presence of a “UV peak” (turn 20), and Theo places the crosshair-shaped pointer on a specific part of the absorption spectrum. That is, the three scientists participate in a language-game where that sound /ju: vi:/ and certain perceptual features have a currency: it is content of their talk, orients their activity, associated with other (material) features of the setting, such as visual forms on another part of the monitor that the three point to while producing the sound /ju: vi: kəʊn/ (“UV cone”). Ethnographers visiting the laboratory may come to participate in the language-game when they have become sufficiently familiar with using the sound appropriately and anticipating its use on the part of others.

A Pragmatic Approach for Education

Concerning language, many (non-pragmatist) language philosophers and linguists agree on three principles (Davidson, 1986): (a) first, literal meaning is systematic such that the basic properties of statements and parts thereof constitute a basic framework on the basis of which words may be interpreted; (b) to make communication possible, first meanings must be shared; and (c) there are acquired conventions and regularities acquired in advance of communication that govern first meanings. Traditional, non-pragmatist assumptions about language further suppose that the languages we speak somehow constitute a unity that stands between self and reality (Rorty, 1989), whether the latter is taken in the realist or constructivist sense; and these assumptions suppose that language somehow is faithful to the true nature of the self or, in other words, that what speakers say truly reflects something within them. This latter assumption, for example, is implicit in (clinical) interviews designed to elicit what students (teachers) know, what students believe (e.g., nature of science), or their (science) identities to list but a few of the currently popular topics of science education research. In all these cases, researchers presuppose that what a person says invokes something else, “meaning” or “understanding”—as many other private, internal, and subjective things like opinions, feelings, or beliefs science educators investigate (e.g., Allen & Crowley, 2014)—that come to be revealed to the interlocutor by means of language. Such suppositions are intelligible “once we accept the idea that there are nonlinguistic things called ‘meanings’ which it *is the task of language to express*” (Rorty, 1989, p. 13, emphasis added).

In the opening quotation of this text, Wittgenstein (2000) writes that “understanding” and “meaning” have no place in his considerations (i.e., in the language-game he offers up to us and invites us to play). He does so because, for example, the “philosophical concept of meaning has its place in a primitive idea of the way language functions” (Wittgenstein, 1953/1997, p. 2 [§2]). In this section, I describe and explain why a scientific discipline of education does not require these terms for theorizing language-in-use or, for that matter, for establishing approaches consistent with *concrete human psychology* (Vygotskij, 1929/2005b) or concrete approaches to sociology (Garfinkel, 1967). A pragmatic view of language-in-use and an aim at concrete human psychology and sociology radically decenters theoretical discourses we currently mobilize for theorizing what happens in classrooms and the traces that these happenings leave in individuals and in collective practices and institutions. This section focuses on (a) the way in which topics of traditional discourses can be addressed and constituted very differently in a pragmatic language-game, (b) concrete societal relations as the form, origin, and place of knowing, and (c) the use of the documentary method as an alternative to “understanding” and “meaning.”

The Pragmatic Approach and Traditional Education Discourses

The theoretical and empirical discourses of (science) education are populated with the terms “understanding” and “meaning.” Whatever these terms denote, however, is elusive and not available in language itself. Indeed, language is treated as something between the self and (a) others, (b) the natural world, or (c) meta-physical things when in fact we are exhorted to take language “simply as a flag which signals the desirability of using a certain vocabulary when trying to cope with certain kinds of organisms” (Rorty, 1989, p. 15). It is then possible to abandon the idea that there are two or more meanings that are attributed to different students using the same words, or between the “meanings” that students attribute to certain (science) words and those that scientists (science educators) attribute to them. Reflecting upon whether there can be wrong meanings, Wittgenstein (1976) writes, “There is only one thing that can be wrong with the meaning of a word, and that is that it is unnatural” (p. 243), where an example of an unnatural word would be “reddish-green.” The real distinction pragmatists make is that between “familiar and unfamiliar uses of noises and marks” (Rorty, 1989, p. 17). The uses of marks and noises always are related and keyed to specific circumstances, so that what we recognize to be the same noise-word—e.g., “force,” “heat,” or “velocity”—actually have different, for students generally unfamiliar uses when they come to school and science class. Taking the pragmatic route to education, we no longer would have the separation between knowing *that* and knowing *how*, because all knowing is knowledgeable use in relevant settings, that is, is knowledgeable participation in setting-specific language-games. This pragmatic view therefore also dispenses of the notion of “different languages as a barrier between persons or cultures” (Rorty, 1989, p. 14). The view directly addresses issues that educators conceptualize as border / boundary crossing (e.g., Aikenhead & Jegede, 1999; Akkerman & Bakker, 2011) or in terms of a third cultural / linguistic space that intervenes between the primary space of home language and secondary space of discipline language

(e.g., Handa & Tippins, 2013; Seiler, 2013). From a pragmatist perspective, saying that there are linguistic barriers and translation difficulties “is just to say that the linguistic behavior of the inhabitants of one community may, like the rest of their behavior, be hard for inhabitants of the other community to predict” (Rorty, 1989, p. 14).

“Understanding,” too, may be dropped as unnecessary because in any case, assuming for the instance the usefulness of the term, we know that someone “understands” only in and through his/her moves in the language-game at play, which may be an interview, a laboratory practical test, or some written examination (Wittgenstein, 1953/1997, §146). Too often, a problem is made in considerations of the relation between speech and “understanding (thought),” which really is a pseudo-problem in the face of the question concerning the relation between speech and the activity at hand, that is, how speaking contributes to the doing of whatever is being done (A. A. Leont’ev, 1969), playing at the language-game at hand. Analyzing language-use independently of current activity—e.g., the production of schooling—is doing research consistent with analysis in terms of elements and doing research against the principles of unit analysis (Vygotskij, 1934/2005). In a strong sense, there is not even speech activity—only speech acts that are integral to the specific productive human activity, whether it is of theoretical, intellectual, or practical nature (A. A. Leont’ev, 1969). The advantage of using terms such as speech activity, despite its terminological imprecision, is that it forces us to always consider language-use only in its constitutive (dialectical-unity-forming) relation with productive activity as a whole.

The pragmatist position on language-in-use described here allows us—in fact requires us—to drop the idea of language as a means *to make present again* (re-present) whatever appears on the inside of a person. That is, we have to drop the idea of language as a form of representation, whether it be of the world, contents of mind, (mental) constructions, or some other aspect of the self. The view takes as its fundamental stand that language allows us to do things in the relevant segment of the world, and new languages afford doing new things impossible before. Thus, for example, the notion of language-game allows us to decenter the ongoing and popular discussion about *individual* students’ (mis-, alternative, naïve) conceptions (e.g., Romine, Barow, & Folk, 2013; Taber & Tan, 2011). Such alternative conceptions have been called the “elements of ‘hard-core understanding’” (Taber & Tan, 2011, p. 289). Rather than considering students’ inappropriate (“poor”) “understanding” or “misplaced meanings,” the pragmatic approaches leads us to describe and explain the kind of language-games that they participate in. The ones most commonly played are different from those of scientists, though many aspects (like words) appear in both.

The games science students and scientists play are different in the way Australian footy is different from American football, or in the way rugby is different from American or European football (soccer). Educators would then be concerned with the games people (including students) play and how to introduce them to different kinds of games, with different rules. It would be immediately apparent that we tend to learn language-games by participating in them and prior to any explicit knowing of rules (e.g., grammar, or how to make a queue). We do not find it surprising, therefore, that an astronomer points out to her son the marvelous spectacle of a *sunrise* or *sunset*—even though at work she would never speak about the sun as moving (setting, rising). At the instant that she and her son look at the rising or setting sun,

they are playing at a game different from that played in the astronomical observatory, where the very entities invoked (here celestial bodies) tend to be different (Weil, 1990). Focusing on language alone allows educators to by-pass the production of conditions that for Wittgenstein are irremediable components of the language-game—unless we tacitly allow schooling to be the relevant context. In this case, then, the language-game played is schooling, which implies that we need to be more worried about the schooling than about the nature and contents of a curriculum. These latter are secondary, may also occur, though the primary and overarching language-game is “doing school” (cf. Holzkamp, 1993).

Words and names, such as when a teacher points to an entity in the science laboratory and says, “this is a Dewar flask,” would not yet be a language-game. It is the preparation of such a game of the same kind as placing a chess figure on the board (Wittgenstein, 1953/1997). In fact, the name is relevant only in the respective language-game (cultural-historical activity). A particular name will be used to play at different rules in different language-games, something science educators have investigated in the context of conceptions and conceptual change. An example would be the different ways in which students or scientists use and relate words such as velocity, momentum, and force. One of these games, the one commonly played outside of schools and prior to instruction has been played since Aristotle; the other, less frequently played has been played since Galileo and mostly among scientists, science educators, and science teachers.

Learning as Participation in Concrete Human Praxis and Relations

From a pragmatist perspective, language is not a thing with a shared structure that has to be acquired together with or prior to the thing. The implication is that “there is no such thing [as a language] to be learned or mastered” (Davidson, 1984, p. 44). As a consequence, the pragmatist approach requires us to “give up the idea of a clearly defined shared structure which language-users acquire and then apply to cases” (p. 446). In a pragmatist approach, learning is considered differently: It is an increasing familiarity with parts of the world, including the linguistic genres in play, which are in fact action resources. An evolving language simply provides to its user new tools for doing what they could not have done before, for participating in language-games (productive activities) in which they could not participate to the same degree before. It expands learners’ powers to act in relevant settings (Holzkamp, 1993). New words afford the changing of old and the playing of new games, not just the naming of things unknown before, such as when physics students encounter words such as “entropy” or “enthalpy,” which enrich the language-games (not just language!) that can be played while talking about the transformations (changes of state) of physical systems.

It is common to investigate students’ language without taking into account the particular setting.⁹ Thus, educators tend attribute “scientific understanding” and “meaning” to the words

⁹ Vygotskij (2005) already made this point when he points out that the central point of Piaget’s constructivism was the “attempt to derive the logical thinking of a child and his entire development

students use independent of the language-game at play, which, depending on context, may be interviewing (e.g., Salter & Atkins, 2013), participating in after-school science programs (Tan, Barton, Kang, & O'Neill, 2013), or being part of school science (Bennett et al., 2010). Language-games, like cultural-historical activities, however, cannot ever be considered isolated from the societal relations, from life of society (A. N. Leont'ev, 1983; Wittgenstein, 1953/1997). This is so because society produces the activities of the individuals that constitute society. Behind word-use “is hidden societal praxis, transformed and in it crystallized activity” (A. N. Leont'ev, 1983, p. 111), and it is only in language-use that objective reality reveals itself to the user. The needs and requirements in this objective reality constitute a motive for the appearance of words. Thus, the word “emerges/comes to be in the process of societal praxis and therefore is a fact of objective reality, independent of individual consciousness of man” (Vygotskij, 1956, p. 9).

The notion of language-game allows us to talk about the origin of knowledgeable practice in cultural-historical activity theory, where higher psychological functions are said to first exist *as soci(et)al relations*. Little children do first speak in and for relations with others before they begin to speak to and for themselves (Vygotskij, 1929/2005b). In the same way, children learn to play science-specific language-games (including language) with others—e.g., in situations such as those that Siry and Max (2013) describe or the types of science reading games even one-year old toddlers may play with their parents (Roth, Goulart, & Plakitsi, 2013)—before they play them alone. The different card games denoted by the term “solitaire” are but one type of example where a game necessarily is learned in relations to others prior to being played by individuals alone. We do learn these games with others before playing them (recognizably and according to the going rules) alone—such as when we learn to speak science before making private notes for ourselves. We become good at employing language by experiencing the effects we produce with it on other people (insulting, praising, ironizing). From a psychological perspective, the initial and original form of language (use) lies in dialogical communication with others; and these dialogical forms constitute the societal relations (Vygotskij, 1934/2005): “From a psychological point, dialogic speech is the original form of speech” (p. 996). At the root, language emerges (as consciousness does) from the needs and necessities of relating to other human beings (Marx/Engels, 1958). The primary role of language, therefore, is the constitution of relations. The origin of language, as that of consciousness, lies in society; language and consciousness are societal products. Language both produces and is produced in society-specific relations with others. Language not only is the result of praxis but also shapes praxis. That is why the future development of language cannot be predicted: New conceptual languages cannot be developed through inference or discovery on how old discourses fit together (Rorty, 1989).

It is perhaps not surprising then that Vygotsky emphasizes soci(et)al relations as the first instantiation of all higher psychological functions: It is as these relations *between* people that these functions exist. Participating in these inherently relations *is* learning. The psychological nature of human beings is the result of “the ensemble of societal relations, *shifted to the inner and having become functions of the person and forms of its structure*”

from the pure intercourse of consciousness in total isolation from reality, without any consideration of the child's societal practice aimed at the mastery of reality” (p. 732).

(Vygotskij, 1929/2005b, p. 1023, original emphasis). The author terms it ridiculous to search on the inside of persons for specific centers of supreme and higher psychological functions—the origin and logic of psychological functions is social, realized in relations between people. Vygotskij points to a specific place in the works of K. Marx, who writes: “Language is as old as consciousness—language *is* the practical, also for other people, and thus also for myself existing real consciousness” (Marx/Engels, 1958, p. 30). Marx also writes that the production of ideas, representations, and consciousness is directly tied into the production of material life and into the material relations of people, the language of real life. That is, the production of everyday life, language, and consciousness are irreducible. Because “man . . . = *an aggregate of societal relations, embodied in an individual*” (Vygotskij, 1929/2005b, p. 1028), language never is private and always reflects how words are used in society-specific relations between people.

Those things that we attribute to the private mind, thought and the will, are from a cultural-historical standpoint “the product of social relations: *a command, a condition*” (Vygotskij, 1929/2005b, p. 1026). Commands are also at the beginning of Wittgenstein’s account of how language functions, exemplified in his narrative about the builder commanding the helper to bring differently shaped building materials by articulating specific sound-words. The dialogical relations with others presuppose knowing what is being talked about, which, depending on the degree to which speaker are familiar with each other and the topic, may lead to a radical shortening of the actual statements made (Vygotskij, 1934/2005)—such as those that we observe in the fragment from the laboratory or those from science classrooms that have been reported in the literature (e.g. Roth, 2013a).

The pragmatic approach to language generally has a number of implications for the way educators talk about the nature of science and individual learning. The evolution of language at the cultural level is contingent, so that even the great inventors of new language (discourses)—e.g., poets, artists, or scientists—do not know in advance what they are doing in language until, with hindsight, they have arrived at a new language that also allows them to explain what they have been doing (Rorty, 1989). Thus, the cultural changes that are called scientific revolutions do not have a telos, a given endpoint that the inventors of a new language aim at and develop. That there are difficulties involved in finding such new languages can be seen by the often long temporal periods between the initial stirring to the final results—Rorty speaks of 100 years that it took to move from the Ptolemaic to the Copernican worldview. In the meantime, the language-games in play constituted “inconclusive [conceptual] muddle” (p. 6) because of logical inconsistencies within language as between language and natural facts. This historical case also points to a second implication: learning a new conceptual language at the individual level. If the great “poets” of science—e.g., Galileo, Newton, or Einstein—are “typically unable to make clear exactly what it is that [they] want to do before developing the language in which [they] succeed in doing it” (Rorty, 1989, p. 13), how much more must this be the case for ordinary science students generally, most of whom will never pursue a career in science or science-related field?

The Documentary Method and Concept Learning

In the pragmatist approach, it is not useful to think in terms of “meaning,” for to construct it, small children would have to know what a meaning is prior to constructing the first relation between it and a word. The same is with “understanding,” for to construct it (intentionally), a child who first “constructs” “understanding” when words are used already would have “to understand” what it is “to understand.” These requirements are circular, which is why Davidson (1986) states that there is no such thing as language in the traditional sense. It only leads us to circular definitions of the requirements underlying competent use of language. How then should we talk about traditional science education concerns such as how students come to “understand” a “scientific concept,” its “meaning”? Wittgenstein discusses the different ways in which “to understand [*verstehen*]” is used—e.g., to be able to replace a statement by its equivalent and to be able to say in which way a statement cannot be replaced by another one—and suggests that the different uses constitute the *concept* of “to understand,” its “meaning” (Wittgenstein, 1953/1997, p. 143–144 [§531, 532]). Restating is precisely what we observe when a student follows a teacher’s turn by saying, “what do you mean?” (Roth, 2013c). Familiarity with the language-in-use across different language-games then allows us to distinguish the different ways in which the same words come to be used and to differentiate it from the uses in other language-games. “Seeing red,” then has very different places in different language-games without requiring researchers to talk about “meaning” and “understanding.” Thus, for example, a student in the laboratory looking at a test tube in which a chemical reaction takes place and says “he sees red” is heard differently from a faculty member saying “he sees red” while her male colleague is in a shouting match with another person, which is again different if the person attends a *corrida* and says “he sees red” while a bull is charging the red cape, which is different from a spectator in a soccer match saying “he sees red” when the referee pulls and holds up a red card. In the ways in which we learn to distinguish between the different uses of “he sees red,” we also learn to distinguish between situations when it is appropriate to speak about the sun as rising and setting and those situation where it is inappropriate to talk about the sun as moving with respect to the earth.

In which way might we consider competent participation in science across multitudes of settings? We can get an appropriate clue from the *documentary method* that underlies our everyday ways of developing competent strategies for getting around the world specifically (Garfinkel, 1967) and for identifying a worldview or the *zeitgeist* of an area more generally (Mannheim, 2004). Take competent participation in forming a queue. Queues exist in many forms and in many places, in the walk-in clinic, the supermarket checkout counter, in front of a traffic light, in the passport office, or at the bus stops. These queues are of very different kinds and expressions, some involving also tickets that one has to take somewhere. We do not learn any explicit rules of forming a queue; and yet, we become very competent at participating in forming one should there be a need and in recognizing when a person does not conform to implicit and unstated rules even in those cases where a queue would be a novel form of behavior. We competently participate in forming queues in and through our participation in forming queues in the course of our lifetimes, in and through our familiarity with situations where queues are formed. Toddlers and small children learn language in the same way, by participating in its use rather than by learning a set of rules prior to speaking. If

we take the ways in which people find their ways around the world as an analogy for learning science, then the upshot is clear: Science students have to have many opportunities for engaging in language-games, doing and talking science. The amount of time it takes to become familiar with a new city or a new culture allows us to anticipate that it will take a lot of time to become familiar with the language-games characteristic of science. Science educators will have to abandon simplistic ideas of concept learning. Importantly, students, who encounter new forms of language that do not have a place in the language-games they are familiar with; in fact, they are unfamiliar not just with the language but with the language-game as a whole, as activity plus the language that goes with it forming an irreducible unity. This implies that students *cannot have* a set of criteria for judging the adequacy of a word or phrase. Because a new phrase does not have a place in a familiar language game, students cannot confirm, disconfirm, validate, or argue against it. If students retain it rather than abandoning the form of talk, that is, if they savor it rather than spitting it out, then the words will gradually acquire a habitual use, a familiar place in the language-game students play.

Coda: As New Wine for New Bottles

Oftentimes when some new theoretical approach is offered, peer reviewers claim that a text offers old wine in a new bottle, or new wine in old wineskins. This surely cannot be said about the pragmatist perspective articulated here, which is very different from how educators use “understanding” and “meaning” related to language-in-use. It changes the ways in which we describe knowing and learning; and it changes the ways in which we have to consider and plan for learning experiences. That is, the pragmatist way not only changes the world, as Piaget conceived learning, but changes world and perception, as Merleau-Ponty (1945) described it.

The pragmatist perspective actually is consistent with other ways of describing and explaining human activities. Thus, for example, despite very different cultural-historical origins, there are many similarities in the projects of Wittgenstein and Vygotsky. These similarities exist because of the common focus on real, concrete life, the use of language in the production of life and societal relations, as well as for doing things. There is further commonality of this approach with the ethnomethodological approach to sociology, which is concerned with how (i.e., method) people (i.e., ethno-) work to constitute and concretely exhibit to each other the social reality they inhabit (Garfinkel, 2002). These approaches take educators in the direction of a concrete human psychology that abandons any notion that appeals to metaphysical and solipsist concepts that residualize linguistic human behavior in the individual’s mind.

The pragmatist approach constitutes a new form of language-game, which reorients science education. In this way, we also enact the real program Vygotskij (2005) described in a chapter entitled “Concrete Human Psychology,” which aspires to explain individual and collective functioning of human beings on the basis of concrete, public facts and societal relations that make it intelligible what and how persons acquire specifically *human* (social-psychological) characteristics. Pragmatist philosophers have a similar orientation, as shown in the fact that Rorty (1989) calls Davidson a “nonreductive behaviorist about language” (p. 15). Indeed, the

very idea of a science—including social science—is based on the collective study of phenomena based on data investigated by all. Concrete human psychology and sociology are scientific disciplines that embody fundamentally pragmatic approaches to operate with concepts and empirical categories that denote phenomena not only accessible to researchers but also accessible to those very people who constitute social life as an orderly phenomenon. “Meanings” and “understandings” of words, because these generally point to metaphysical things (e.g., Nöth, 1990), inherently are not useful in the concrete and pragmatic approaches explicated here. Unsurprisingly is, therefore, Wittgenstein’s statement that these have no place in his considerations. At best, we might ask, reflexively, “What are researchers doing when they invoke phenomena that cannot be pointed to directly, that are not of the concrete world we inhabit, and that allow reducing the social world to processes in the minds of (solipsistic) individuals?” “In what kinds of language-game do ‘meaning’ and ‘understanding’ have a place?” and “What is the nature of the language-games in which these terms have a place?”

This study contributes to establishing a science of education that rids itself of any appeal to metaphysics and its concepts that may inhere in it. Getting rid of the terms “understanding” and “meaning” is equivalent to abandoning what Wittgenstein (1953/1997) calls a “language more primitive than ours” (p. 2 [§2]), that is, it is equivalent to abandoning a particular language-game in favor of another one that is better suited for talking about learning in an increasingly connected world constituted by (digitally sustained) relations with others. I suggest getting rid of these terms not because they can be used differently, in the way Wittgenstein continued to use them even though suggests abandoning them. Instead, getting rid of the terms undercuts the possibility itself of importing metaphysical readings. Wittgenstein actually proposes that the way in which a word is used *is* its meaning. This leaves open the possibility to continue using the term. But continued use then also leaves open its old uses, and, therefore, interferes with transiting to a new use. Discarding the word from use—in the way we discard other words, e.g., because they are now offensive and politically incorrect—may foster a much faster transition to a pragmatic approach to learning. The pragmatic approach, and the concrete approach to human psychology that it implies, moves us away from talking about what happens in individual minds and what individuals do. It turns us instead toward societal relations that we have in common and produce together in their orderly ways; and it turns us to those things, like language, that we *inherently share* because we use them to affect others and, eventually, ourselves.

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