

Moving Between Discourses: From Learning-As-Acquisition To Learning-As-Participation

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Abstract. In this paper I address the question of how to talk about learning so as to be able to cope with at least some of the longstanding quandaries and to arrive at new insights. After a very brief historical review, I concentrate on two basic metaphors for learning in which current educational research seems to be grounded: the metaphors of learning-as-acquisition and of learning-as-participation. After stating the importance of both of these approaches and arguing that researchers should be adjusting their leading metaphors to the questions they ask, I present my own choice: a brand of participationist discourse which is grounded in the vision of thinking as a form of communication and of physics and mathematics as types of discourses. The usefulness of the proposed way of talking about learning is then illustrated with the help of empirical materials taken from my recent study on a 7th grade class just introduced to *negative numbers*.

Keywords: Acquisitionism, participationism, commognition, discourse, learning

THE QUESTION: HOW TO TALK ABOUT LEARNING?

The point of departure for this paper is the assumption that what educational researchers notice in their studies and what teachers do in their classes depends on how they all talk about teaching and learning. It is also assumed that no one discourse – no single consistent set of basic tenets – would suffice to grapple with all the questions about teaching and learning that are likely to be asked. In this presentation I propose a certain particular way of talking, called *commognitive*, which I found helpful in dealing with the complexities of the processes learning and teaching mathematics. Let me stress already at the outset that although I will do my best to show the usefulness of this special discourse, I will not be claiming either its exclusivity or its definite advantage over existing or future alternatives. I will invite you, however, to reflect on the question whether the discourse which was developed specifically for studying the learning of mathematics may be appropriate for studying physics learning as well.

To initiate the conversation, let me present an example to think with. This is a story of one typical Israeli 7th grade class just introduced to negative numbers [1]. The teacher, an ardent follower of the principle of autonomous learning [2], provided the students with several concrete models for the extended number set and invited the children to "figure out by themselves" how different pairs of signed numbers could be added or multiplied. Her expectation was that

the things would proceed smoothly most of the time, and that her direct intervention would become necessary only when the students get to the multiplication of two negatives, where the concrete models stop working.

The actual course of events was different. The class stumbled already when asked to calculate "positive times negative". Only some of the children interpreted expressions such as $6 \cdot (-2)$ as repeated additions ("this is like -2 plus -2 six times, so it's -12 "). Others claimed that the answer was 12 because in this case, one needs to multiply "the numbers themselves" (absolute values of a multiplier) and add the sign of the "bigger one". As illustrated by the following excerpt from the ensuing classroom debate, it was this latter idea that appealed to the majority of the children:

Naor: Plus 12 because 6 is bigger than 2.
Teacher: What is your opinion? What do you say, Vladis?
Vladis: Me too: Plus 12 because 6 is bigger.
.....
Teacher: You repeat time and again what Roi said last time. I need to understand why.
Yoash: Because this is what Roi said.
Teacher: But Roi did not explain why it is so – why it is according to the bigger ...
Roi: Because there must be a law, one rule or another
Teacher: Ok, there must be some rule. But why this one?
Leah: Yeah... The bigger is the one that decides.

In spite of the lengthy debate with recurrent references to the concrete models which, on the face of it, should have convinced any skeptic about the inevitability of the canonical option, the class

remained bitterly divided over the question of how to multiply positive by negative. After almost two hours of futile debates the teacher decided to cut it short by presenting her own authoritative verdict. To her dismay, the children received the resolution with manifest disbelief. They continued being skeptical when the teacher introduced multiplication of negative by negative and demonstrated how the rule "minus times minus is plus" follows from the general properties of numbers. It seems, therefore, that the most tangible result of the learning was the students' distrust of the kind of reasoning that mathematicians regard as legitimate and convincing.

This turn of events raises the obvious question of what went wrong in this classroom, and of whether and how this seemingly unfortunate development could have been prevented. Before trying to respond, let me make some conceptual preparations. In the meantime, you may wish to look for your own answer, growing from your own vision of learning.

LEARNING AS PARTICIPATION

Although there seems to be general consensus that learning means change, the question of what it is that changes when a person learns does not have a unique answer. The many ideas raised in the course of history, be them as diverse as they might, can be divided into two broad categories, according to their underlying metaphors: the metaphor of learning as *acquiring* something (knowledge, concepts, schemas, etc.) and the metaphor of learning as perfecting one's *participation* in some kind of activity. The former metaphor dominates colloquial discourses and constitutes the central motif of the influential work of the French psychologist Jean Piaget, according to whom learning is the activity of constructing mental entities known as schemes. The metaphor of learning-as-participation won its current prominence thanks to the work of the Russian thinker Lev Vygotsky, who claimed that it is the child's capacity to gradually become a competent participant, and eventually a modifier of historically established patterned forms of activity that sets human kind apart from any other. For example, learning to speak, to solve mathematical problem or to cook means *individualization* of these activities, that is, a gradual transition from being an only marginally involved follower of other people's implementation to acting as a competent participant, with full agency over the activity.

The images of learning-teaching processes generated by acquisitionist and participationist discourses differ in many respects: in their resolution, in the underlying unit of analysis, and in the roles ascribed to biological determinants on the one hand and to human agency, on the other. Although they

often seem to contradict each other, these apparent inconsistencies may, in fact, be an illusion resulting from differing uses of the same words. Indeed, acquisitionist and participationist ways of talking are *incommensurable* rather than incompatible: When the same words are used differently, there is simply no common measure for resolving the ostensible contradictions. All this means that the two approaches can live side by side, just as do wave and particle theories of subatomic phenomena. In neither case does the simultaneous presence of apparently contradictory narratives about the world pose any threat to the overall consistency of the research enterprise. Once we understand that much, we also realize that the question of the veracity of our narratives must give way to the question of these narratives' usefulness.

Our choice of metaphors should depend on the questions we ask. In what follows, I present the choice I made in my own research. My decision resulted from the realization that quandaries about learning mathematics such as those that emerged from our negative-numbers study remain intractable unless one assumes that mathematizing, just as any other uniquely human form of human doing, is a historically developed form of activity which is learned through interactions with others rather than through a direct contact with nature [3].

SCHOOL LEARNING AS DEVELOPING DISCOURSES

The commognitive framework to be presented in this section, is an almost inevitable consequence of participationism, tailor made to deal with the specific questions of school-type learning. Following, is the glossary of the commognitive discourse.

Thinking. Although thinking appears to be an inherently individual activity, there is no reason to assume that its origins are any different from those of other uniquely human capacities. As with all the others, the phylogenetic and ontogenetic sources of this special form of human doing is probably in an activity that individuals can watch performed by others and in which, eventually, they can participate themselves. At a closer look, the best candidate for the public activity that morphs into thinking through the process of individualization is *interpersonal communication*. Indeed, thinking can be defined as self-communication – one's communication with oneself. This self-communication does not have to be audible or visible, nor does it need to be verbal. Additional support for this definition comes from the observation that the activities we usually call *thinking* are clearly dialogical in nature – they are acts of informing ourselves, arguing, asking questions, and waiting for our own responses.

According to this definition, thinking stops being a self-sustained process separate from and, in a sense, primary to any act of communication, and becomes an act of communication in itself, although not necessarily interpersonal. To stress this fact, the terms *cognitive* and *communicative* were combined into the new adjective *commognitive*. The etymology of this last word will always remind us that whatever is said with its help refers to phenomena traditionally included in the term cognition, as well as to those usually associated with interpersonal exchanges.

Discourses. With its roots in a patterned collective activity, commognition – both thinking and interpersonal communication – must follow certain rules. These rules are not anything the participants would follow in a conscious way, nor are they in any sense “natural” or necessary. The source of the rules is in *historically established customs*. This contingent nature of communicational rules is probably the reason why Wittgenstein decided to speak about communication (language, in fact) as a kind of *game* [4]. Just as there is a multitude of games, played with diverse tools and according to multitude of rules, so there are many types of commognition. Like in the case of games, individuals may be able to participate in certain types of communicational activity and be unable to take part in some others. The different types of communication that bring some people together while excluding some others will be called *discourses*. Given this definition, mathematics and physics, whether as taught in schools or as practices in the academia, can certainly count as discourses.

Discourses differ one from another not only in their meta-rules, but also in the objects they refer to and in the media they use. Thus, for example, mathematics and physics are made distinct by

- (a) their *keywords*, such as *negative number* or *force*, and the way these words are used;
- (b) *visual mediators*, such as graphs, algebraic symbols or the readings of laboratory instruments; all these are means for identifying the object of talk and coordinating communication;
- (c) *routines* - sets of meta-rules that define patterns in interlocutors’ actions, that is, determine or just constrain the patterned course of discursive action and the circumstances in which this action may be undertaken;
- (d) *narratives* that the given discourse community *endorses* and labels as true; narrative is any text, spoken or written, which is framed as a description of objects, of relations between objects or of activities with or by objects; $6 \cdot (-2) = -12$ and $E = mc^2$ are good examples of narratives endorsed by mathematics and physics communities, respectively; terms and criteria of

endorsement may vary considerably from one discourse to another, and more often than not, the issues of power relations between interlocutors would play a considerable role.

From this conceptualization of mathematics and physics it follows that mathematical objects, such as negative numbers, and the objects of physics, such as energy or forces, are discursive constructs, created for the sake of communication about the world. As such, these objects reside in discourses, not in the mind-independent reality – this, as opposed to those phenomena that happen in the world itself and are describable in terms of *negative number* or *force*.

Discursive learning. The adjective *discursive* narrows the present debate to learning that changes commognition, as opposed to many other types of learning (e.g. learning to drive or to play a musical instrument that change our actions with concrete rather than discursive objects). For example, learning mathematics means modifying one’s present discourse so that it acquires the properties of the discourse practiced by mathematical community. Within commognitive framework, therefore, asking what the participants of a study have yet to learn becomes equivalent to inquiring about required transformations in students’ ways of communicating. Discursive development of individuals or of communities can then be studied by identifying modifications in each of the four discursive characteristics: the use of words and of mediators, in the endorsed narratives and in routines.

It is important to stress that when equating thinking with self-communication I was *defining* thinking rather than making an empirically verifiable assertion. The quality of definition such as the one proposed here expresses itself in its inner *coherence*, *adequacy*, *operationality*, and *usefulness*. While leaving the task of examining the first three criteria to the reader, I focus in the rest of this paper on the issue of usefulness of the commognitive discourse.

APPLYING COMMOGNITIVE LENS

My commognition-guided attempt to answer the question of what went wrong with the teaching and learning of negative numbers observed in our study will now be made in two steps. First, I will try to fathom the nature of the change that was supposed to happen in students’ mathematical discourse. Subsequently, I will ask whether the observed learning-teaching interactions could be, if only in principle, conducive to this kind of discursive development. As I go on, you are invited to reflect on how well my claims apply to learning physics, if at all (think of, say, *force* whenever I say *negative number*).

The nature of expected learning. In most general terms, two types of changes can result from discursive learning. One is an *object-level change* - a straightforward extension of the discourse, something that happens when new narratives on existing discursive objects are endorsed or new routines added. This is, for example, the kind of learning that takes place when the discourse on *function* is already well-developed and the students explore new families of functions. The other type of learning, which can be described as *meta-level*, produces changes in the rules of the game, that is, existing meta-discursive rules are replaced, usually in a tacit way, with new ones. As a result of this learning, some familiar tasks, such as, say, substantiating a definition or identifying geometric figures will now be performed in a new way and the resulting discourse will be incommensurable with the previous one.

It can be shown that getting acquainted with negative numbers is a case of meta-level learning: It requires a change in meta-rules of substantiating narratives. Indeed, as long as the discourse was exclusively about unsigned numbers, only those narratives were endorsed that seemed to be imposed by the world itself. There is no concrete model, however, that would dictate the rule "minus times minus is plus" [5]. This latter narrative is a derivative of previously endorsed narratives on numbers and, as such, rests exclusively on the principle "all is endorsable that preserves inner coherence of the discourse."

Learning by invention – what is possible? I now wish to claim that the method of unguided reinvention, which is a reasonable approach when object-level learning is expected, is an unlikely choice when it comes to meta-level learning. Indeed, whereas object-level narratives are necessary entailments of those narratives that were previously endorsed and there is practically no possibility of a non-standard invention, meta-discursive rules are a matter of human choices, and there is thus little chance that students' meta-level invention would replicate those of the mathematicians. Theoretically speaking, optimally inventive meta-level learning is one which I would call *inventive imitation*. Such learning involves, first, *object-level imitation*, that is, spontaneous immersion in the new discourse; this is the type of learning which one witnesses when children learn their mother tongue; and second, *meta-level re-invention* – an ongoing attempt to discover the meta-rules of this new discourse, along with their rationale.

Two conditions must be fulfilled to make the inventive imitation possible. First, as an invitation to imitative participation, the learner must be exposed to the new discourse. In other words, an expert participant of the new discourse must actually practice this discourse so that the learners can observe and join.

However, since the old and the new discourses are incommensurable, the co-participation of the experienced and non-experienced interlocutors is bound to create a *communicational conflict* – an incoherence stemming from differences in the forms of participation. In order for the conflict to turn into a lever rather than obstacle to learning, the second condition has to be in place: there must be a *democratic learning-teaching agreement* – a tacit agreement between all the participants of the teaching-learning process on the following three issues: Which of the conflicting discourse should be followed? What are the respective roles of different participants? How is the process of discourse change is likely to happen?

None of these two conditions was honored in our study. As a result, the students' object-level invention failed to be re-invention, and worse than that, the teacher's discursive leadership, once renounced, proved difficult to win back.

I began this paper with the meta-question: *How should we talk about learning mathematic (physics) so as to solve our problems?* I hope to have shown that theories are but optional ways of talking about the world. I also hope to have convinced the reader that we can do without the dichotomy of thought and communication.

REFERENCES

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3. A. Sfard, *Thinking as communicating: Human development, the growth of discourses, and mathematizing*. Cambridge, UK: Cambridge University Press, 2008.
4. To be precise, Wittgenstein spoke about language games. L. Wittgenstein, *Philosophical investigations: the German text, with a revised English translation*. 3rd ed., Malden, MA: Blackwell Publishing, 1953/2003.
5. Of course, different physical phenomena are describable in terms of signed numbers. It can be argued, however, that these phenomena, although quite likely to become models for the discourse on negatives when this discourse is already in place, cannot be expected to effectively serve as stepping stones for the creation of this discourse.