1.3 Metaphors in education

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Introduction: there is more to metaphor than meets the eyes

Metaphor in *education*? In a poem – yes; in novels or journal articles – yes; in orators' inspired speeches – yes; but in education? The unruly linguistic move that brings surprise and stirs emotions – what does it have to do with propagating established forms of activity and rules of conduct, which education is all about? Aren't teaching and learning too serious a business to allow for frivolity like this?

These days, many writers challenge the view of metaphor as a mere literary gimmick and argue that metaphors are, in fact, everywhere and, yes, also in education. In this chapter, an even stronger claim is made: without metaphors, human beings would not be what they are. As it turns out, metaphors underlie our ability to explore new territories and build new knowledge. They shape our thinking, and through thinking, they mould our actions. As such, they are also full of pitfalls. While this claim is generally true, it is of particular importance in education. Here, our choices of metaphors may affect nothing less than human lives. In what follows, after a brief discussion of what metaphors are, I focus on their role in educational research and practice. Special attention is given to the question of how to utilize metaphors as props and how to make sure that they do not turn into traps.

Metaphor: what is it and why do we need it?

Metaphor as 'discursive transplant'

In the search for metaphors, one needs to listen carefully to what people are saying. Indeed, metaphor is a discursive construct – it is a particular way of making assertions. Some metaphors are easy to notice. Thus, for example, the appearance of the words *like* or *as* is one of the most reliable signs of their presence. To realize this, it suffices to take a closer look at expressions such as *an atom is like a solar system*, *she was brave as a lion* or *teaching is like growing a garden*.[1] But metaphor can be present in a text even if unannounced with any special linguistic marker. When one says that she found a book *indigestible*, we do not imagine this person pushing printed pages into her mouth and then processing them in her intestines; and when one states that she is *love-sick*, we do not propose to rush her to a hospital. The common property of these and the former metaphorical expressions is that in all cases a word from one thematic domain has been embedded in another one, thus entering a network of new linguistic relations. For instance, we transplanted terms from the discourse on gardening into the discourse of education, and those from the discourse on food and digesting into the one on books and reading. This is, indeed, what metaphors are all about:

they are transplants[2] from one discourse to another.[3] Having said this, I am now in a position to make a number of claims about what metaphors do to us and to our lives.

Metaphors are catalysts of new knowledge

Like any transplant, a metaphor is not a mere add-on; rather, it is often a source of a whole new way of speaking, that is, of a new discourse. As such, it is a source of new ways of seeing things. To say it metaphorically, discursive crossbreeding may result in a new discursive species. This happens much more often than we may readily realize. Dislocating words from their 'native' discourses into unexpected contexts is a common occurrence. As we go on using the familiar words in unfamiliar linguistic setting, we construct new discourses and thus new conceptual systems.

In this process of discursive expansion, our perceptual experiences are primary building materials. Under a close scrutiny, traces of language that pertain to the perceptual and the bodily are visible even in the most abstract of our concepts. Consider, for example, expressions such as *transfer of learning* or *grasping a meaning*, both of which sound so familiar that we may have difficulty recognizing their metaphorical origins. And yet, since these expressions make use of the verbs *transfer* and *grasp*, it is clear that they both have been inspired by discourses on physical actions with material objects. As shown in these examples, metaphors often cross the borders between the physical and the mental, between the concrete and the abstract.

Figurative projections also cross boundaries that separate the intuitive and the formal. Conveyed through language from one domain to another, metaphors enable conceptual osmosis between colloquial and scientific discourses, letting our primary intuition shape scientific ideas and letting the formal conceptions feed back into the intuition. Indeed, these days, philosophers of science agree that metaphors play a central, constitutive role also in research. In fact, no kind of scientific endeavor would be possible without them (Hesse, 1966; Ortony, 1993). What has been traditionally regarded as merely a tool for a better understanding and for more effective explaining of scientific theories is now recognized as these theories' primary source – as a mechanism through which one becomes able to organize new experiences in terms of the previous ones.

The idea that new knowledge originates in old knowledge deserves some elaboration. Although it has been promoted by all theoreticians of human development, from Piaget to Vygotsky to contemporary cognitive scientists, the question of how the old is transformed into the new remained a vexing puzzle. The quandary was first signaled by Plato in his dialogue *Meno* and came to be known later as *the learning paradox* (Bereiter, 1985; Cobb *et al.*, 1992; Sfard, 1998). Although seen in many different disguises throughout history, the question has always been the same: how can we want to acquire knowledge of something which is not yet known to us? If we can only become cognizant of a thing by recognizing it on the basis of the knowledge we already possess, then nothing that does not yet belong to the assortment of the things we know can ever become one of them. Conclusion: creating new discourses – or knowledge – is inherently impossible.

The recent work on metaphors as agents of discursive (conceptual) change offers a way out of this entanglement. Metaphors function as harbingers and catalysts of such change, owing their constitutive power to the fact that familiar words, even if transplanted into a new context, can still be used according to at least some of the old rules (think, for example, about your own ability to get an initial sense of what is being talked about when you come across a familiar colloquial term, such as *strain* or *messenger*, in a hitherto unfamiliar scientific context, where they appear in such expressions as *cognitive strain* or *messenger DNA)*.

Once the metaphorical term is introduced into the 'target' discourse, the rules of its use, as well as those of the discourse into which the metaphor was inserted, are mutually adjusted, resulting in a whole new form of talk – and possibly a new scientific theory!

Metaphors **shape** *our thinking*

Since the seemingly innocent act of transplanting a familiar word into an unfamiliar context may, in fact, be a beginning of a new form of communication, choosing a metaphor is a highly consequential activity. In fact, it may amount to no less than an upheaval in the way we understand the world. Indeed, since thinking can be conceptualized as *communication with oneself*, the way we talk is the way we think. Saying that metaphors shape our discourses is thus tantamount to saying that they shape our thinking.[4]

The special power of metaphorical expressions lies in the fact that even their very first appearance in an unusual context makes us feel as if we already knew a great lot about the phenomena they describe. When we say, for example, that *teaching is like growing a garden*, many of the statements about gardening known as true are now unreflectively taken as true also for teaching. Thus, for example, the gardening metaphor entails a tacit assumption that the general trajectory of student learning, just like the growth of a plant, is inscribed in genes and that our role as teachers is to provide the child with optimal conditions for the realization of this biologically determined potential.

You may be so accustomed to this latter vision of learning and teaching that it may appear to you as an unassailable truth about the world, and by no means a mere product of a metaphor. Thus, how about the following thought exercise: could you think about some other metaphors with which you would like to describe teaching? Do these other metaphors lead to the same conclusions about the teacher's role in student's learning? If you manage to implement the task you will see that when the metaphor changes, your understanding of how things work is also likely to change. Greek historian and essayist Plutarch was obviously aware of the difference a metaphor can make when he made the following disclaimer: 'A mind is a fire to be kindled, not a vessel to be filled.' You may wish to reflect on the change in our thinking about thinking that takes place when the latter metaphor for mind is supplanted by the former.

Metaphors **shape** *our actions*

Because metaphors shape our thinking, they are bound to shape our practical actions too. Indeed, our thinking mediates all our moves: we usually think about what and how to do before making any actual step – and this may be true even if one's conduct appears 'thought-less'! This simple truth has been encapsulated in the following statement by the soviet psychologist Lev Vygotsky: 'The gist of human activity is in the dialectic unity between speech and the activity of solving practical problems' (Vygotsky, 1978, p. 24).

To become aware of the impact of metaphors on our practical actions, think about how the shift from the metaphor *mind-as-a-vessel-to-be-filled* to *mind-as-a-fire-to-be-kindled* may affect one's way of teaching. Suppose you are a history teacher and you would like the students to learn about Punic Wars. If you are guided by the mind-as-vessel metaphor, the odds are that you will spend your time in the class at the blackboard, trying to 'transmit' to the students your own knowledge: telling them about what happened, filling them with facts, dropping names and dates. If, on the other hand, you ground your thinking, and thus your teaching, in the mind-as-fire metaphor, you are likely to make some deliberate attempts to 'kindle' your students' curiosity. Rather than just telling them historical facts, you would

first ask them to study the map of Mediterranean in the third century bce, encouraging them to reflect on territorial aspirations of the then powerful Carthaginian empire and the gradually expanding Rome. You would then suggest that they put themselves in the shoes of either Romans or Carthaginians and think about what their leaders would be likely to do. Indeed, curiosity, like a fire, does not need more than being kindled to do its work.

Metaphors do their work from behind the scene

The upshot of what has been said so far is that, for better or worse, metaphors are behind almost anything we say, think or do. It is only rarely, however, that we recognize the metaphorical connection. More often than not, we take metaphorical entailments for granted and, unaware of their genesis, treat them as facts of life which are nobody's to question. This makes some of our guiding 'truths' inaccessible to critical inspection.

While in force for any kind of metaphor, this statement is particularly relevant for 'extinct' ('dead') metaphors – for those figurative expressions the metaphorical origins of which have long been forgotten. Indeed, 'discursive transplants' are at their most powerful when they lose their 'foreign' identity. Metaphor of object, discussed below, is one of those implicit and extremely influential metaphors that pervade all our discourse. Because of its far-reaching educational consequences, it deserves our special attention.

The metaphor of object

The very ubiquity of the metaphor of object makes it practically transparent to discourse participants. Its invisibility is also due to that the fact that the things we say with its help are not easily translatable into 'literal' statements. This metaphor, as many others, has its roots in our tendency for picturing the abstract and inaccessible in the image of the material and tangible. In what follows, after explaining its nature and the reasons for its omnipresence, I argue that in educational context the metaphor of object is a rather mixed blessing.

Objectifying discourses

Consider, for example, the following words, related to learning and thus central to educational discourses: *concept* (or *conception*), *knowledge*, *learning disability*, *abstraction*. Although none of these terms is pointing to a concrete, tangible object, each one of them does seem to refer to a certain self-sustained, well-delineated entity existing at a certain location, possibly in a human head, and enjoying a permanence similar to that of material objects. The object-like effect is attained through the special linguistic forms in which the words usually appear, and which are very close to forms used in descriptions of the material world. Compare, for instance, the three expressions on the left that deal with mental activities, to the three on the right that speak about actions with material objects:

1a Two of my students *constructed* similar *conceptions of fraction*.

1b Two of my students *constructed* similar *Lego towers*.

2a He cannot cope with the topic because he *has* a *learning disability*.

2b He cannot help with my luggage because he *has* his own *bags* to carry.

3a We have to *give* our students a better *access to* mathematical *abstraction*.

3b We have to *give* our students free *access to* the *National Museum*.

Although only half of the sentences deal with tangible things (Lego tower, bags, museum), in all six of them people are said to act on, or to be somehow directed or constrained in their action by an entity which, even if perceptually inaccessible, is implied to have an independent existence, of sorts. The main point I am trying to make here is that the metaphor of object is not a mere substitution for a more literal formulation of the same 'things', but rather is what creates these 'things' in the first place. My argument goes as follows: to begin with, the entities to which we point with the words *conception, learning disability* or *abstraction* are not anything that can ever be observed directly; instead, what we see while conducting a *(mis) conceptions* survey or when running *learning disability* diagnostic tests is *people in action*. It is only when we are describing our impressions that we turn to entities the presence of which is likely to escape anybody but those who act as expert observers. The act of *objectification* – of translating a discourse about *doing* into a discourse about *being* or *having* – may be exemplified with the following three translations:

4a In the majority of school tests and tasks dealing with fraction she regularly *did well* and *attained* above average scores.　→　**4b** She *has a good conception* of fraction.

5a In the majority of school tests and tasks she regularly *did well* and *attained* above average scores.　→　**5b** She *is a good student.*

6a He *cannot cope* with even the simplest arithmetic problems in spite of years of instruction.　→　**6b** He *has a learning disability.*

Once we objectify a discourse, we no longer notice the metaphorical nature of the objectified terms; rather, we see these terms as speaking about things-in-the-world that are not any less present and real than what we can see with our eyes or touch with our hands. Like with words such as *Lego tower*, *bag*, or *museum*, we feel that the use of the words *conception*, *learning disability*, and *abstraction* is a matter of world-imposed necessity, not of linguistic choices; and if the claim about the metaphorical nature of the latter notions is difficult to accept, it only shows how successful we have all been in the project of objectifying!

Metaphor of object in educational discourse

At a closer look, all our discourses are replete with objectifying metaphors, and the specialized disciplinary discourses are no exception. To verify this claim, it suffices to recall such scientific terms as *energy*, *momentum*, or *speed*, all used in physics to describe motion of bodies; or terms such as *number* or *functions*, which are objectifications of the mathematical procedures of counting and of set-to-set mapping, respectively; or expressions such as *ego*, *superego*, *belief*, *attitude*, *intention*, *IQ, mental schema*, or *personality*, used in psychology in describing and explaining human actions.

In the context of education, it is useful to have a closer look at the discourse on cognition. Its objectifying quality is manifest in the definition offered by *Webster's New Third International Dictionary*: although described as a process, cognition is said to result in 'knowledge about perceptions and ideas'. This is echoed by the *Collegiate Dictionary*, which defines cognition as 'the mental faculty or process by which knowledge is acquired'. These definitions are reminiscent of Plutarch's 'mind as a vessel to be filled' metaphor: they make us think of knowledge as a kind of material, of human mind as a container, and of the learner as becoming an owner of the material stored in the container (see also Johnson, 1987).

In the view of this, it does not come as a surprise that the *Collins English Dictionary* defines

learning as 'the act of gaining knowledge'. From this definition, learning emerges as the activity of transferring some entities from one place to another. The metaphor of *learning-as-acquisition* is consonant with our thinking about knowledge as composed of smaller entities. Such decomposability and, conversely, gradual constructability, are salient properties of tangible things. Among the components of knowledge one can list such objects as *concept, conception, idea, notion, misconception, meaning, sense, schema, fact, representation, material, contents.* There are equally many terms that denote the action of making such entities one's own: *reception, acquisition, construction, internalization, appropriation, transmission, attainment, development, accumulation, grasp.* The teacher may help the student to attain her goal by *delivering, conveying, facilitating, mediating* and so on. Once acquired, the knowledge, like any other commodity, may now be *applied, transferred* (to a different context) and *shared with others.*

To recap, the objectifying quality of traditional discourses on cognition and learning expresses itself in the fact that they dichotomize human doings and present them in the dual terms of processes such as *thinking*, *cognizing* or *learning*, on the one hand, and of the products of these processes, such as *knowledge*, *concepts*, *ideas*, on the other hand. All these pertain to an individual learner who is the sole implementer of the processes and the exclusive collector of the products. Being denoted with nouns, the products emerge from these accounts as phenomena more permanent than the processes that brought them into being and also as fully separable from these activities, in that each one of them is now believed to be 'constructible' or 'acquirable' in many different ways. Let me now reflect on gains and pitfalls of educational discourses that picture human processes in this objectified way.

The gains of objectification in educational discourse

Objectified discourse has at least two important advantages over its unobjectified counterpart: it is more parsimonious and it increases our ability to make sense of our experience.

Gain 1: Communicational parsimoniousness and accumulativeness of achievement

The act of discursively turning our own actions into object-like entities vastly increases the effectiveness of communication. To see how it happens, just have another look at the sentences 4a, 5a, and 6a above and notice the relative brevity of their objectified counterparts 4b, 5b, and 6b. Metaphor of object, therefore, makes communication more economical, and thus increases its effectiveness. You can now say much more with much less. Having squeezed lengthy narratives about processes into succinct utterances about objects you may also proceed to new levels of complexity, telling stories about how different processes interact and how they can be improved or combined one with another. Objectifying may thus be the very technique that renders our communication its unique power to accumulate achievement. It is this periodic 'compression' of our discourses that comes with objectification that allows each generation of humans to begin shaping its unique forms of activity from where the former generations left off rather than reinventing the wheel every time anew.

Gain 2: Effectiveness of the discourse as a tool for sense-making

The effectiveness of the metaphor of object as a tool for understanding what is going on and for organizing our subsequent practical actions stems from the fact that it helps us to deal with incessant change. Our relations with the world and with other people are fluid, sensitive to our every action. Objectifying is an attempt to 'make the moment last' – to collapse

a video clip into a generic snapshot. It is grounded in the experience-engendered expectation, indeed hope, that in spite of the ongoing change, much of what we see now will repeat itself in a similar situation tomorrow. Consider, once more, sentences 4a, 5a, and 6a on the preceding pages. Although seemingly equivalent, their objectified versions in the right column (4b, 5b, 6b) seem to encourage somewhat different interpretations. In the former type of utterances, the fleeting, the passing, and the changing gives way to relatively permanent, immutable, and ever-present. This, in turn, gives rise to the reassuring conviction that tomorrow we will be able to step into the same river again.

Objectification, therefore, makes us able to cope with new situations in terms of our past experience and gives us tools to plan for the future. Objectifying sentences are not only concise, but also reassuring. Saying *She has a mathematical gift (potential)* makes us confident that the next time this person is charged with mathematical tasks, she will perform to our satisfaction. More generally, objectifying is the ongoing attempt to overcome the transitory nature of our experiences and to gain the sense of security. While objectifying, we overcome distance in time and in space – we 'fold up' the fourth dimension and make the absent present.

In the light of all this, one cannot help concluding that objectification is not anything we could easily give up.[5] This said, we need also to remember that the spectacular gains of objectification are not risk-free.

Pitfalls of objectified educational discourse

As effective as objectifying techniques are in natural sciences, they may be less than helpful when applied to people and their actions. As explained below, there are at least four ways in which excessive objectification of educational discourse can undermine the utility of this discourse and may even bring harm to those toward whom our educating efforts are directed.

Pitfall 1: Overgeneralizations

When talk about processes is replaced with talk about objects, many different forms of actions, e.g. solving certain type of mathematical problems, may be described with the same noun, e.g. *misconception*. This economizes our talk but diminishes its differentiating power. Of necessity, this new talk is bound to gloss over many differences, some of which may be of vital importance. Thus, when we speak of learning in terms of externally given intellectual 'goods' that wait 'out there' to be 'acquired', we expect that the goods themselves and the processes of making them one's own will be more or less the same across different settings. There is quickly accumulating empirical evidence that contradicts this expectation. Research tells us about people who, although diagnosed as having a certain 'conception', would soon display behaviours that are at odds with this conception. There is ample evidence showing that task implementation is highly sensitive to the situations in which the activity is performed, to the history of the activity, and to the cultural background of the performers.[6] This undermines the tenets on cross-cultural and cross-situational behavioural invariants in which the acquisitionist discourse is grounded.

Pitfall 2: Logical entanglements

By objectifying, we often entangle ourselves in controversies which have every appearance of disagreements about the 'correctness' of one's world-view but, in fact, cannot be resolved

by appeals to empirical evidence. The mechanism that produces the illusion of controversy over facts, while simple, is also mostly invisible: following objectification, we often interpret statements about discursively constructed entities as statements about objects-in-the-world, existing independently of the discourse. This 'ontological collapse' may result in at least two types of complications. First, the objectified talk about human doings may lead to tauto-logical statements disguised as causal explanations. For example, we are likely to say that a child's repetitive failure in mathematics is *caused* by her *learning disability*. And yet, what was identified as the *cause* for the child's invariably unsatisfactory actions is nothing more than the label inspired by properties of the actions. These properties have been objectified and thus presented as in a sense separate from the actions. No value was thus added by the learning-disability 'explanation'. Second, in 'low-resolution' discourse, in which diverse forms of actions may hide under the same objectifying description, such as grades or diag-noses, the differences between individual forms of activity practically disappear. Obviously, overlooking the differences largely diminishes the chances for effective interventions.

Pitfall 3: Self-fulfilling prophecies

Grades and labels such as *learning disabled* may become harmful in yet another way. Although constructed on the basis of one's former actions, they are usually read as statements about the subject's future. The objectified descriptions, which more often than not take the form of statements about one's *abilities* or *potentials*, tend to function as self-fulfilling prophe-cies. Indeed, words that make reference to factors that outlast actions have the power to make one's future in the image of one's past. As agents of continuity and perpetuation, the objectifying descriptions deprive a person of the sense of agency, restrict her sense of responsibility and, in effect, exclude and disable just as much as they enable and create. In particular, when the effectiveness of learning is seen as determined by such personal givens as *potentials, gifts* or *disabilities*, failure is likely to perpetuate failure and success is only too likely to beget success.

Pitfall 4: Normative influences

The metaphor of learning-as-acquisition bears a tacit normative message: it makes the activity of learning into the pursuit of personal possession, comparable to the activity of accumu-lating material assets. Such commodification makes learning into a competitive endeavour, subject to rules not unlike those that govern the pursuit of material goods. It turns school into an arena of power games, where the learner is jolted back and forth by other people's competing interests.

Disobjectifying educational discourse: learning as participation

In response to the much debated weaknesses of objectified educational discourses, a new metaphor for learning has been gaining much visibility for some time now. Perhaps the most salient sign of its presence is the disappearance of such objectifying terms as 'concept' or 'knowledge'. The terms implying an existence of permanent entities are being replaced with words such as 'knowing', 'practising', 'participating' that indicate action. Within this new educational discourse, learning is said to be induction into historically established forms of collective activity (or discourse). The basic tenet is that the learner must gain experience in

implementing the activity together with people more skilled than herself, before the activity becomes 'her own', that is, she is able and willing to perform it on her own while solving her own problems. For this reason, some writers replace the word *learner* with the term *legitimate peripheral participant* (Lave and Wenger, 1991), where the word *peripheral* indicates that the participation skills are not yet fully developed and the adjective *legitimate* softens the message and signals the acceptability of this incipient form of participation.

The metaphor of *learning-as-participation* that underlies this new educational discourse should probably be considered as a complement to the acquisition metaphor rather than as its competitor. Although the new metaphor scores high on those accounts on which the older one fails, the reverse is true as well: the participation metaphor shows relative weakness in the areas of the other metaphor's particular strengths. Because participationists refuse to squeeze descriptions of complex human processes into concise but oversimplified stories about permanent entities, their narratives cannot possibly be as thrifty, elegant and supportive of generalized statements as those of the acquisitionists. For the same reason, participationists' stories are not nearly as conducive as their acquisitionist counterparts to the soothing message of stability and predictability. On the other hand, participationists outperform acquisitionists on many of those accounts on which one's ability to inform and improve educational practice seems to depend. First, the same features that sometimes make participationist descriptions messier increase the differential power of these descriptions and thus prevent overgeneralizations. Participationist high-resolution portrayal of learning makes us more aware of individual needs and possibilities. As such, it is a more promising basis for instructional design. Second, in the discourse that avoids dichotomizing and does not stipulate unobservable entities, there is little danger of the logical entanglement typical of objectifying discourses. Third, participationist stories that make no reference to stabilizing entities and permanent traits are much less likely to perpetuate failure. Finally, the normative message of participationist descriptions and analyses is just the opposite of the one carried by the metaphor of object: participationism stresses the value of being a part of collective and favours collaboration over competition.

Conclusion: let one thousand metaphors bloom

Metaphors have emerged from the above account as a double-edged sword: on the one hand, they are among those basic mechanisms that make our advanced thinking possible; on the other hand, they keep our imagination within the confines of our former experience and conceptions, and if not operationalized, they can lead to inconsistent, confusing uses of words and an unhelpful vision of human processes. Since we live by our metaphors, we need to optimize these metaphors' benefits and minimize their risks.

There is more than one way to do so. As a user of metaphors, you may benefit from the following advice. First, be always aware of your metaphors – try to elicit them and then handle them with care. Remember that when speaking with metaphors you may be saying things you did not intend to say, and since what you say is what you get, you may end up not getting what you wanted. Second, be accountable for the way you speak: operationalize your metaphors – be explicit about how you use words and how your uses correspond to those of other interlocutors. Third, let the one thousand metaphors bloom. There is no better cure for unwanted entailments of one metaphor than another metaphor's alternative entailments. Above all, however, be always mindful of the possibility that the things you believe are products of metaphors you select rather than empirically verifiable truths imposed by the reality itself. As the creator of your world rather than its mere ventriloquists, you have as much responsibility for as freedom in shaping your own and other people's lives.

Notes

1   Some experts on rhetoric may argue that this figure of speech, one that states a *similarity* of one thing to another rather than their *equivalence*, is called *simile*, not metaphor (this distinction, let me remark, is famously difficult to make: note that similes can also be said without the words *as* and *like*: *an atom is a (miniature) solar system*, *teaching is growing a garden*, etc.). In this article, however, where the focus is on the question of how non-routine linguistic associations inform our thinking, this distinction is irrelevant. Thus, the word metaphor will be used here inclusively, to denote simile as well.

2   Note the recursive nature of the definition of metaphor as 'discursive transplant': metaphor has been defined with the help of a metaphor! As stated by Paul Ricoeur, 'The paradox is that we can't talk about metaphor except by using a conceptual framework which itself is engendered out of metaphor' (Ricoeur, 1977, p. 66).

3   Some authors speak about metaphor as a *mapping from one conceptual domain to another*. It was Michael Reddy (1993, first published 1978) who, in the article 'Conduit metaphor', alerted us to the ubiquity of metaphors and to the fact that they come in thematic clusters. Using as an illustration the notion of *communication*, he has shown how words characteristic of one discourse may take us in a systematic way to another, seemingly unrelated one. In his example, he spoke about the figurative projection from the discourse on *transport* to that on *communication*. Since Reddy's seminal publication, what came to be known as *conceptual mappings* has turned into an object of a vigorous inquiry (Sacks, 1978; Lakoff and Johnson, 1980; Lakoff, 1987, 1993; Johnson, 1987).

4   For the elaboration and the history of the idea of thinking as self-communication see Sfard and Lavie, 2005; Sfard (2008). Let me stress: because communication does not have to be verbal, the communicational definition of thinking does not imply that all our thinking is in words. Note also that the word *discourse* is used here as any type of communication, not necessarily linguistic. This said, much of our thinking is verbal, and even non-verbal (e.g. pictorial or gestural) communication is affected by how we talk.

5   In mathematics, the effect of the 'ban on objectification' would be particularly dramatic. Just imagine we can count, but we did not objectify the discourse on numbers: we do employ number-words for counting, but do not use them as nouns supposed to signify self-sustained objects. In this situation, there is no possibility of impersonal propositions such as $3 + 4 = 7$ (or, in words, *three plus four make seven*) because the number-words *three*, *four*, and *seven* do not function as nouns. In such situation, how do we express the general numerical truth encapsulated in the brief symbolic statement $3 + 4 = 7$?

6   See e.g. studies on market sellers (Cole, 1996), tailors (Lave and Wenger, 1991), street vendors (Nunes *et al.*, 1993), dairy warehouse loaders (Scribner, 1997), shoppers and weight-watchers (Lave, 1988) and nurses (Hoyles and Noss, 2001).

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Scribner, S. (1997) 'Mind in action: a functional approach to thinking', In M. Cole, Y. Engström, and O. Vasquez (eds), *Mind, Culture, and Activity: Seminal Papers from the Laboratory of Comparative Human Cognition*, Cambridge, Cambridge University Press, pp. 354–68.

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Sfard, A. and Lavie, I. (2004) 'Why cannot children see as the same what grownups cannot see as different? Early numerical thinking revisited', *Cognition and Instruction,* 23(2), pp. 237–309.

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Reflective questions

1   Choose a page in one of the chapters in this volume (the page should contain continuous text, not list of references or table of contents). Identify on this page all the words and expressions that seem to have metaphorical origins. In each case, try to answer the following questions:

   a   Can the metaphorical expression be replaced by another, more 'literal' one? Can it be operationalized, that is, defined with the help of publicly identifiable characteristics?

   b   What are the possible entailments of the metaphor? Do all of them match the present context, in your opinion? Are they all desirable?

   c   Is any of the identified metaphors the metaphor of object? If not, look at the text again. The odds are you will find one!

2   Does the change from the metaphor of acquisition to that of participation make a difference in school teaching? In other words, does it matter, in your opinion, whether the teacher thinks about students' learning as *acquiring something* (acquisition metaphor) or as *perfecting their participation in certain well-defined, historically established forms of activity*? To answer this question, think about a specific school subject and look for possible differences between 'acquisitionist' and 'participationist' teaching of this subject.

Further reading

Lakoff, G. and Johnson, M. (1980) *The Metaphors we Live By* Chicago: The University of Chicago Press.

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