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Children's representations of learning through drawings

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ABSTRACT

The main purpose of this paper is to describe a drawing-based method able to track down young students' representations of their own learning process. This method is used also to analyze whether the metaphors proposed by learning theorists correspond to those produced by students, and whether students' representation of the learning process is affected by demographic variables. 528 students – from ages six to 10 years old – were asked to draw and comment on the way they imagine what happens in their mind when they learn at school. Mixed-method analyses were adopted. Firstly, the drawings were qualitatively assessed through a coding scheme; secondly, a quantitative analysis was run to study the effects of dimensions such as gender and students' grade. The results allowed us to draw two main conclusions: a) the metaphors the literature produced describe only partially how students represent their own learning processes; therefore, students learning representation can be defined as multidimensional; and b) the developmental path of learning representation is observable by grade and, to some extent, by gender.

1. Introduction

Educational researchers, educators, and educational institutions, including schools, are invited to consider the way in which individuals learn to learn, rather than just dealing with the content and outcomes of learning (Biesta, 2006; Quisumbing, 2005). Such a perspective implies an inevitable turning point in considering students and learning. Indeed, individuals have to be conceived as actively approaching learning activities, building their own knowledge, and going beyond the boundaries of information and the acquisition of competences (Brown & Campione, 1990; Scardamalia & Bereiter, 2006; Wenger, 1998). For example, Chi and Wylie (2014) suggest that student learning in general increases when students become more engaged—moving from passive to active—via the learning materials and task demands presented to them, as well as those they produce. Fiorella and Mayer (2015) inventoried eight learning strategies that promote this engagement—generative learning activities consisting of student drawing, imagining, and enacting, for example, all of which result in higher levels of comprehension and reflection. Generative learning activities—particularly, in the employment of graphics and drawing—are well-established methods in the

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development of deep cognitive processing resulting in durable learning outcomes (Mayer, 2014). Thus, learning is a complex process involving developmental changes of students, strictly intertwined with the activities performed, the tools used, the interactional construction of knowledge, and students' learning conceptions, all of which play an important role in relation to learning behavior and the quality of learning outcomes (Ligorio, 2010; Bruner, 1990, 1996; Cole, 1996; Rogoff, 1990; Vermunt & Verloop, 1999).

And yet, we content that the attempts to operationalize learning paths in educational contexts cannot ignore the learners' perceptions and the way they represent their own learning process (Klatter, Lodewijks, & Aarnoutse, 2001). Many authors stress the need for a deeper understanding of learning representations of young primary school children (Marton, Dall'Alba, & Beaty, 1993; Säljö, 1979; Vosniadou, 2001). To overcome this gap, we developed a method based on children's graphical representations of their own learning process. In this paper, we present our method, its application, and the results obtained with an Italian sample.

First, a conceptual framework about learning representations is provided as a foundation of our study. Second, the act of drawing as a method is reviewed. Third, the method we proposed is described. Finally, in the last section, the findings and limitations of our study are discussed.

2. Theoretical framework

2.1. Theories about learning representation

Educational sciences have made a great effort in finding ways to describe the learning process. One of the most interesting ways has been using metaphors. Sfard (1998) retrieved two main and contrasted metaphors: acquisition and participation. The first one – the acquisition metaphor – considers learning as an act of gaining knowledge and acquiring concepts. This metaphor considers the human mind as a container—a box to be filled with notions provided by an expert or contained within sources featured by the special status of "educational material". The second metaphor –participation—views learning in terms of a trajectory of participation (Lave & Wenger, 1991) or as an apprenticeship in thinking (Rogoff, 1990). According to this second metaphor, learning is conceived as a process of becoming a member of a certain community. Sfard (1998) warns of the risk of accepting only one of these metaphors because each metaphor can only cover a small part of the complex phenomena of learning and "each has something to offer that the other cannot provide" (p. 10). In particular, the acquisition metaphor gives a good account of individual cognitive processes, whereas the participation metaphor is more focused on the social and contextual dimensions connected to learning.

Paavola and Hakkarainen (2005) add a third metaphor: the knowledge creation metaphor. These authors consider this latter metaphor more adequate in depicting the conception of learning within a modern knowledge society. This is "a kind of individual and collective learning that goes beyond information given and advances knowledge and understanding: there is collaborative, systematic development of common objects of activity" (p. 536). Many contemporary models of learning embrace this metaphor; for instance, the model of knowledge building proposed by Bereiter (2002) and Scardamalia (2002), the model of knowledge creation by Nonaka and Takeuchi (1995), and the model of expansive learning by Engeström (2014). All these models have in common the attempt to explain not only how people—individually or collectively—learn, but also how knowledge advances through learning, as well as the connection with innovation processes implied within knowledge advancement.

2.2. The need to include participants' points of view

The theories and metaphors discussed above are, in our opinion, well representative of how scientists and researchers consider the learning process. Nevertheless, it is unclear if these metaphors can be retrieved when students describe their own learning process. As theories embracing cultural psychology invoke (Cole, 1996), there should be more attention toward the students' perspective, trying to understand their points of view on the phenomena being studied.

There is evidence that learners' overt behavioral production during learning activity can provide a window into the degree to which learners cognitively represent *what they learn*. *Haglund, Jeppsson, and Andersson* (2012), for example, found that seven- and eight-year-olds, when attempting to learn difficult science concepts of heat transfer, performed analogical reasoning better and created their own analogies more successfully when they were permitted to produce drawings of their conceptual understanding and explain that understanding to their classmates. In another example, Schmeck, Mayer, Opfermann, Pfeiffer, and Leutner (2014), in two experiments, found that when 8th grade students were asked to draw pictures while learning a scientific text, the students' comprehension of the concepts explained in the text was significantly enhanced. Thus, both investigations illustrate that learner-generated pictures, by the act of drawing, leads to new learning and is a bona fide activity revealing the way students cognitively represent what they know. The drawing action is a phenomenon referred to as the Generative Drawing Principle in Multimedia Learning—a principle explaining that the act of drawings is a generative process of cognitively recoding verbal propositions from text to spatial relational codes in visual-motor action, an action that produces deep cognitive and metacognitive processes leading to deeper understanding.

The problem is that there is little evidence as to how students cognitively represent *their own learning*, and whether the Generative Drawing Principle would be able to explain this type of cognitive representation. Thus, students' ways of considering and explaining *their own learning* should enter the research scenarios as much as the evidence of the way the students cognitively represent *what* they learn, as well as other researchers' hypotheses and interpretations of the former. Thus, the point of view of a student is crucial data to study psychological and social phenomena elicited and examined systematically and sensitively relative