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Unit of analysis from an ecological perspective: Beyond the individual/social dichotomy

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ABSTRACT

Unit of analysis is a methodological staple in the constitution of any learning theory, determining how different frameworks lead to different kinds of empirical observation. In this regard, emerging ecological—sociocultural and situative—approaches have been distinguished from more classical frameworks in that their units of analysis are said to expand beyond the individual to include their social contexts or environments. However, elaborations on unit of analysis are scarce and often build upon a formalistic distinction between the “individual” and the “social,” where differences among frameworks tend to be oversimplified and dichotomised. To contribute remedying this situation, in this study we shift attention into the logics of explanation that underlie different formulations, and distinguish between formal and ecological logics. Grounding our discussion on analyses derived from a participant ethnography at an arts-based school, we discuss how, whereas formal logic tends to focus on objects and their relations, ecological logic—consistent with dialectical logic—allows defining units of analysis that capture those developmental characteristics proper of (individual, social) life.

1. Introduction: Problematizing the individual-social dichotomy

Defining a unit of analysis is one of the most important moments in any scientific endeavour, including research on learning and instruction. Whereas other methodological assortments such as data collection methods do not necessarily bear the stamp of underlying theoretical assumptions (interviews, for example, are frequently used by researchers operating with very different theoretical premises and with very different purpose), the unit of analysis distinctively reflects a study's theoretical premises. Operationalizing theory into observations, units of analysis determine what the objects of study are, the things “you want to be able to say something about at the end of the study” (Patton, 2002, p. 229), the “what or whom can be studied” (Babbie, 2007, p. 94).

Meta-theoretical reflections concerning how chosen units of analysis relate to given theoretical frameworks, however, are scarce in the literature, limiting opportunities for dialogue across different research environments and frameworks (Säljö, 2009). This is particularly problematic in today's research context, where a growing number of alternative frameworks seek to expand the ways in which we define and explore learning, particularly with regard to how different theories account for the role of the social context in learning.

In order to distinguish among the, in principle, “infinite variety of possible units of analysis in social research” (Babbie, 2007, p. 99), a common strategy consists in drawing distinctions with respect to whether different units capture individual learners or more than just the learners. Thus, textbooks on learning research methods typically list *individuals*, *groups*, *organizations*, *social interactions*, and *social artifacts* as typical units of analysis (Babbie, 2007; Cohen, Manion, & Morrison, 2007). A conviction widely shared seems to be that the line dividing between classical (behaviorist, cognitivist, constructivist) approaches and emergent sociocultural and situative approaches—which here we refer to as ecological approaches—is the line that separates “individual” units of analysis from

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units of analysis that capture the “social” and are “larger than the individual person” (Greeno & Engeström, 2014, p. 128).

But, is the criterion “larger than the individual person” sufficient to distinguish one’s theoretical stance as it plays out in research practice? Consider the following example. In Hutchins’ pioneering analyses of *How a Cockpit Remembers its Speed* (Hutchins, 1995), claims to knowledge do not address the individual, but rather how cognitive functions are distributed among persons and elements in the environment. Still, the premise that cognition consists in the formation of knowledge *representations* is thereby preserved. By contrast, another study also investigates a cockpit as a joint cognitive system, but takes an explicitly non-representational approach, describing the process by means of which a cockpit “forgets” speed in terms not of knowledge representations but of “bodily and embodied knowledge sequentially and temporally organized in flows (kinetic melodies)” (Roth, Mavin, & Murno, 2015, p. 279). Certainly, both studies are interested in studying groups of persons and their relation with and within a larger environment as forming a cognitive system. But the conception of what cognition is, as an observable object of analysis, fundamentally differs. The criterion “larger than the individual” tells little about these theoretical differences.

As the example above suggests, by distinguishing different approaches in terms of whether the focus is on individuals, groups, or larger collectives, we may be drawing distinctions among approaches only at a superficial level, while blurring more substantial differences and how these may impact actual educational (research) praxis. Moreover, differing understandings of concepts such as “individual,” “social,” or “context” co-exist in contemporary literature, with these differences seldom being problematized (Jornet & Erstad, 2018; Roth & Jornet, 2017). Not surprisingly, scholars taking a cognitivist stance cannot agree with critiques that their methodologies do not include or capture situational or social aspects of learning, and defend that their approaches do indeed account for these things too (e.g., Anderson, Reder, & Simon, 1996; Reed, 2012; Vera & Simon, 1993).

In order to contribute with a meta-theoretical discussion on what characterises a unit of analysis that takes relations between persons and their social environments as the minimal phenomenon of interest in this article we move beyond the individual/social dichotomy and instead identify two different logics upon which diverse units of analysis may be defined: formal versus ecological logic. Whereas formal logic conceives of study objects in terms of things and their relations, an ecological logic defines worldly objects in terms of their histories of mutual development. This involves moving away from an ontology of things and into a *fluid* ontology (Ingold, 2015). Our interest thus is not identifying *one* particular ecological unit of analysis, but specifying a general, meta-theoretical framework that defines constitutive features of any unit of analysis that we may label as ecological. In this way, we hope to contribute to prior and ongoing discussions on the specific potential of research grounded on sociocultural and situative theories to expand our understanding of learning and education.

2. Two meta-theoretical approaches: Formal logic and the logic of ecology

In order to address the problem of unit of analysis at a meta-theoretical level, we need to identify what sort of operation is that which leads to defining units of analysis, such that we can then explore whether there may be different classes or types of such operation. A definition that we find useful in this regard is given in Säljö (2009), who describes units of analysis as “the *choice of a conceptualization* of a phenomenon that corresponds to a theoretical perspective or framework” (p. 206, emphasis added). Taking this definition as our starting point, units of analysis are the products of conceptualizing, of rational operations. Discussing unit of analysis at a meta-theoretical level then involves not just contrasting different units, but also identifying the type of rational operation that allows the formulation of this or that unit. The project that we are proposing thus requires us, first, to abandon the view that rational thinking and conceptualizing are given functions that can be taken for granted as shared among all schools of thought, as if only the concepts with which they operate were different.

The belief that thinking is a given, universal function is indeed characteristic of classical cognitivist frameworks, and it has been problematized on both analytical and empirical grounds. Empirically, now-classical cognitive anthropology studies have shown how cognitive processes—e.g., classification, memory—are not universal but context-, culture-bound (Cole & Scribner, 1974). Analytically, a recent volume reviewing the ways in which different analytical traditions have conceived of the very idea of *concepts* concludes that the vast majority of approaches in psychological research have relied, whether intentionally or not, on principles of analytical philosophy and *formal logic*¹ (Blunden, 2012). It is by contrast to this logic that we can begin outlining an alternative that takes not formal objects but ecology—i.e., the transactions between living organisms and their environments—as the starting point. In the following, we draw on the work of John Dewey—a central figure of Pragmatism who also had an important influence from dialectic logic—to describe features of formal logic, as well as of a possible ecological alternative. As we do so, we not only draw on Dewey, but also on connection between Dewey’s arguments and those elaborated by cultural-historical and dialectical materialist thinkers such as Davydov, Ilyenkov, and Vygotsky.

2.1. From formal logic ...

In his *Logic, The Theory of Inquiry*, Dewey (1938) defines *formal logic* as that logic in which knowledge has “a meaning of its own apart from connection with and reference to inquiry” (p. 8). Dewey notes, however, that any rational connection that we find expressed in formal logic, before it became crystalized as symbolic and abstract, i.e., purely formal connection between terms, was a

¹ This is the same conclusion that the Vygotskian psychologist V. V. Davydov (1990) arrived at when noting that, “the characterizations of abstraction, generalization, and the concept that exist in psychology and didactics coincide, in essence, with their description in *traditional formal logic*”

connection achieved through actual, practical inquiry. Consisting of operations upon symbols rather than upon “existential materials” (p. 15), though, the practical and context-bound character of these chains of reasoning becomes easily disconnected. Once this disconnection is achieved, it is operationally possible to warrant claims to truth by sole reference to the formal connections among elements in a formulation, rather than by reference to the actual practical consequences in given (concrete, historical) situations. It then becomes possible “the idea that any knowledge in particular can be instituted apart from its being the consummation of inquiry ... that knowledge in general can be defined apart from this connection” (p. 8). A chiasm emerges separating theory from practice, and knowledge from real, embodied, affective-intellectual inquiry.

A number of features follows that characterize the kind of concepts and categories—and therefore also units of analysis—that can be arrived at using such a logic. First, the formal approach implies a dualism separating the formal and purely symbolic, the concept that describes or *represents* the world, from the messiness of everyday life, which is represented in the concept. Rather than exact copies of reality in all complexity and detail, concepts reflect only so-called “essential” features, which means the regularities that can be abstracted from a collection of concrete instances through abstraction. Through this abstraction, it emerges the premise that the world is made up of individual entities and their relations (an object ontology), where individual entities can conceptually be described in terms of shared, general attributes.

A well-known picture of cognitive operation emerges. To form a concept of, for example, a table, first the table must be perceived as a bundle of attributes in all of its perceptual detail. An undetermined number of attributes may be mentioned: that the table is flat in the surface, that it has legs, that it is made of wood, plastic, etc. But because a concept of table needs to be appropriate to the idea of table in general and not just *this* table, then a method of analysis needs to single out which attributes are essential and which are not. Diverse theories account for this operation, most of them describing some form of categorization process involving comparison across cases, such as in *structure mapping* (Gentner & Markman, 1997), where perception of regularities across situations leads to the generation of increasingly general knowledge representations.

From the formal perspective, units, then, are arrived at by means of abstraction. We may say, “all those units of analysis that are ecological are larger than the individual,” or, “all learning and thinking should be analysed using units of analysis that denote processes of individual minds.” And, as different as these two statements are, unless otherwise disclosed, the logic underlying their formulation may remain the same. At the metatheoretical level, both statements may be the result of the same formal operation of abstraction by means of which, for example, both a bowling ball and a celestial body like the Sun can be said to be spherical objects. As much as the formal “sphericity” of these objects is real in the theoretical domain, and may indeed be useful for given purposes within that domain, there is in reality no necessary objective connection between any given bowling ball and the Sun.² In the same way, conceiving units of analysis for the study of learning in terms of whether they denote individuals, groups, or larger collectives, while useful for many formal analytical purposes—the question “how does a collective learn” is a totally legitimate question that is obviously different from the question “how does an individual person learn”—it does not necessarily say much about how different theories differently conceptualize learning phenomena as fundamentally different objects. It is not the same to say, “I study social groups,” as saying that “I study learning as a social phenomenon.”

2.2. ... To the logic of ecology

What does it mean, then, at a meta-theoretical level, to say that one takes an ecological approach to inquiry, and which type of unit of analysis is proper to such an approach? To address these questions, we believe it is important to clarify what an ecological logic that is alternative to the formal logic presented above can be. For that purpose, we further draw on Dewey, who elaborates on the idea of *inquiry* to offer such an alternative. Whereas formal logic is defined as that which divorces actual inquiry from its outcomes—its objects, observations or claims—an ecological perspective brings the process of inquiry back into the picture.

Rather than something abstract, incorporeal, and prior to concrete and situated operation, rationality is treated as a feature and achievement of mundane, everyday practices. Research methods and the research objects they lead to are *not* something “dependent upon logical forms that are logically prior and external to inquiry” (Dewey, 1938, p. 10), but emerge and take shape in and through the very work of inquiry. Their connection is not just formal but also organic, that is, ecological. Studies of scientific discovery work support this view, showing that scientists often operate with radical uncertainty as to how their actions relate to their scientific findings and observations, so that, in praxis, they need to re-consider that relation several times before they can become certain about it (Roth, 2009).

From this view, concepts are not inventions of the human “mind,” but real achievements of human praxis. Concepts are “thought of” in as much as they are first achievements of human thinking, conceived as human concrete activity (not just mental activity). Accordingly, rather than a dichotomy between moving body and thinking mind, the ecological logic takes the *thinking body*³ as point of departure. In this regard, an ecological logic is also consistent with some of the dialectical materialist premises underlying cultural-historical psychology (Vygotsky, 1987, 1997, 1999).

We say of this form of logic that it is indeed *ecological* because, rather than presenting the process of conceptualizing as an abstract

² One real, objective way in which these objects are connected is by means of human observation and classification practices, which allow for actually finding sphericity in each of these bodies. But then again, these practices are not abstract and a priori, but concrete and historical.

³ A detailed discussion of the idea of the Spinozist idea of the thinking body was first elaborated in Ilyenkov (1977) and has recently been taken up in sociocultural literature on learning and cognition (Roth & Jornet, 2017; Surmava, 2018).

and abstracting process, it naturalizes the process of arriving at concepts and categories, making it part and parcel of the way life activities unfold in actual life contexts. Without neglecting the formal aspects, the ecological perspective approaches thinking and knowing as natural events in the natural world, as parts and outcomes of actual operations of observation that are durational and have practical import. Any object observed (or conceived), “is as much a part of the operation as is the observing organism” (Dewey & Bentley, 1949/1999, p. 116). It truly takes as point of departure the unity between (thinking) organism and environment, and hence it is fundamentally ecological.

3. Implications of an ecological approach to unit of analysis

A number of implications follow from the ecological logic elaborated above, which lead to a way of generating concepts, and by extension also units of analysis, that is different from the sort of concepts and units one arrives at via formal abstraction. Differences concern, more specifically, (1) a different understanding of the research process, which sets emphasis in the situated and genetic (developmental) nature of inquiry; (2) a different understanding of epistemology, i.e., the idea of knowing and how one comes to know, and of what the role of experiencing is in research; and (3) a different understanding of what objectivity and validity mean, setting emphasis in relevance to actual practice as a condition for rigor.

Implication 1: Ecological units denote evolving social wholes that are not pre-established but actually found in and through inquiry.

By contrast to common descriptions found in the learning research textbooks cited above, where units of analysis tend to be defined in advance of inquiry, based on premises that the inquiry's focus should be on a particular level (individual, social, institutional) or attribute (utterances, social interaction, artifacts), an ecological approach demands that *units are not pre-established but actually found in and through inquiry*. Accordingly, the objects of analysis that ecological units allow to draw observations upon are not abstract, but material and durational (Jornet, Roth, & Krange, 2016). Because inquiry takes place in the concrete of life activity, its logic is not of things, nor of entities and their relations, but is one of *events, experiences and situations*, which are messy and holistic in nature.

In this regard, Vygotsky (1987) distinguishes between *analysis by elements*, and *analysis by units*. The former analyses “decompose the [psychological] whole into the elements that form it” (p. 244). Vygotsky exemplifies this with the analysis of water in terms of the elements hydrogen and oxygen. While one achieves a high degree of generalization with this method—all water, whether in a sink or in a sea, is composed of these two chemical elements—one cannot arrive at a satisfactory account of how water enters into meaningful relations with other aspects of the world. Thus, the researcher attempting to account for water's ability to extinguish fire “would find to his [*sic*] surprise that oxygen sustains combustion while hydrogen is itself combustible” (p. 244). In contrast to elements, “units do not lose the characteristics inherent to the whole. The unit contains, in a simple, primitive form, the characteristics of the whole that is the object of analysis” (p. 244). Dewey, too, makes reference to this wholistic aspect of human experience in his definition of *inquiry*, “the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole” (p. 104).

An ecological approach thus demands that units are drawn such that they allow observing the object of analysis not as an aggregate of otherwise abstract elements, but as the “germ cell” (Blunden, 2017; Davydov, 1990, p. 132) or core phenomenon that, in and through concrete history, develops as this or that particular historical (social) object. Accordingly, an ecological analysis involves a *genetic* explanation, the history of how a system or whole emerges and grows over time as a result of mutually transforming relations with its environment. That an ecological unit of analysis addresses a social phenomenon, thus, here does not and cannot mean that it studies groups rather than individuals, or that the social is what people do together as opposed to what they do alone. Instead, the “social” here denotes a historical object constitutive of collective human activity, whether that activity is performed alone, in groups, or across nations. Its study involves understanding its genesis and development as part of an ecosystem of social, political and economical relations. Different objects require different units, but what they have in common is that they are approached as genetic, durational, historical relational objects.

Implication 2: To investigate and come to know an object involves relating to it both intellectually and affectively through concrete experience/activity.

Units of analysis determine the sort of objects that can be known by taking one or another theoretical perspective. This has important implications with regard to the forms of knowing that different units can lead to social (scientific) phenomena. An ecological perspective involves a shift in our understanding of what it means to come to know a research object from or through experience. If epistemologies built upon formal logic have it that empirical objects are experienced in terms of attributes that are abstracted, from the ecological perspective, to know an object involves actively relating to it, and *undergoing* it (Roth & Jornet, 2014). This again re-states the observation that an ecological unit cannot be known in advance of the inquiry but needs to be found. Ecological objects are not wholes in the abstract but in their concrete interrelation with an unfolding environment.

But this second implication adds the observation that units or wholes are not found only intellectually, as a formal elaboration, but also affectively, as an organic, living and lived through relation. Coming to understand something ceases to be a purely intellectual achievement, dissociated from sensuous experience, and reveals itself as an *existential* affair, which from an ecological perspective means that it concerns life-relevant relations between organisms and their conditions of existence in given life environments. Researching using an ecological lens involves thus not a process of abstracting or representing learning phenomena, but a process of *correspondence* and mutual transformation. Correspondence here means that researching through use of ecological units means “not to describe the world, or to represent it, but to open up our perception to what is going on there so that we, in turn, can respond to it” (Ingold, 2013, p. 7). Historical events, episodes, experiences, these are the sort of objects or units that make up (social) lives, which in terms of research methodology implies a different idea of the “empirical.” As researchers come to terms with these

objects, they also get to form part of them and, in changing them, they change themselves.

Implication 3: The validity and rigor of observations, from an ecological perspective, is determined by relevance to practice.

This is an implication that has been developed before, in Pragmatism, but also more recently in the context of research on learning and education (Gutiérrez & Penuel, 2014; Roth, 2015). From implications 1 and 2, it follows that, in actual inquiry, there are intellectual and affective orientations that are *prospective* with regard to some vital need, which in cultural-historical activity theory is referred to as *motive* (Leontyev, 1977). The very emergence of an “indeterminate situation” as the initial moment of inquiry—as per Dewey’s definition—already presupposes the presence of an “end in view” (Dewey, 1938, p. 460). In the logic of ecology, rational operation is motivated, practically and affectively. By contrast to formal objects, which are self-contained and final, ecological objects (and the units developed to capture and study these objects) are not final, not self-contained, but are motive-oriented and motive-orienting, always potentially leading to further inquiry.

Inquiry, the resolution of life activities, “institutes new environing conditions that occasion new problems” (Dewey, 1938, p. 35), which means that “there is no such thing as a final settlement, because every settlement introduces the condition of some degree of new unsettling” (p. 35). Studies using ecological units lead not so much to the establishment of final causes over given learning products or achievements as they lead to the establishment of ways in which given processes and their products relate to future opportunities for development. The scientific goal is therefore not just to identify universal mechanisms of learning, but to learn how these unfold in concrete, historical practices, leading to opportunities of what activity theory researchers refer to as *expansive learning* (Engeström, 2001), “culturally new patterns of activity” (p. 139). This also involves expanding individual and *shared agency* (Damsa, Kirschner, Andriessen, Erkens, & Sins, 2010). A moral and political responsibility is attached then to inquiry, when the latter is understood from the ecological perspective. Inquiry then is not about accurately representing a social phenomenon, but consists in changing and being changed through participation in life activities. In as much as such participation, involves the pursuit of life-relevant goals, the participant researcher engages in overcoming living and lived tensions and contradictions that matter not just to scholars but to the people with whom they engage in research. The validity of the achieved observations and/or findings consists in their stemming from and forming part of actual developmental processes that expand the social phenomena being studied.

4. Implications exhibited: The case of studying creative learner-centred education at an arts-based primary school

In order to provide an empirical basis to our discussion, in the remainder of this article we draw on a participant ethnography as exemplifying case study. Whereas we do not hold that an ecological perspective is tied by necessity to any given method, participant ethnography seems to us particularly appropriate to exhibit the ecological premises and implications exposed above. Particularly relevant is participant ethnography’s premise that coming to know means becoming a competent participant in the social community or practice being studied, “that we can know the world only because we are part of it” (Ingold, 2018, p. 59).

We present an account of the way in which we,⁴ as researchers, came to approach the arts-based school community in order to understand creative learner-centred teaching practices as our object of study. Our presentation, which follows *narrative inquiry* procedures of presentation (Connelly & Clandinin, 1990), aims to exhibit how the analytical implications presented in the previous section play out in actual, concrete empirical materials. Mirroring Dewey’s notion of *inquiry* presented above, our account presents the process by means of which our object of analysis emerged and developed, from a rather abstract, fuzzy, *indeterminate* sense of what we were studying, to a more concrete, integrated and determinate empirical object. Through the narrative, we show how, as part of this process, both research object and knowing subjects change in mutually transformative, ecological relationship.

4.1. Setting, data and participants

Data were collected through a one-year long participant ethnography at a small arts-based primary school in Western Canada. The research was motivated by the aim of better understanding the challenges and opportunities that emerge as school communities work out ways to design and implement innovative and creative learner-centred curricula; in this case, an arts-based curriculum. Learner-centred pedagogies have been defined as those in which “learners have supportive relationships, have a sense of ownership and control over the learning process, and can learn with and from each other in safe an trusting learning environments” (McCombs, 2004, p. 7). Arts-based education, “an approach to teaching in which students construct and demonstrate understanding through an art form” (Silverstein & Layne, 2010, p. 1), has been recognized as a form of student-centered pedagogy. Given increasing calls to foster more creative and creativity-fostering curricula, understanding this type of innovations is a highly relevant task in current educational research (Sefton-Green, Thomson, Jones, & Bresler, 2011).

The entire school community participated in the study, including 3 participant researchers who worked part-time as teacher assistants, 11 staff (teachers, assistants, and administration), and 48 students of ages between 5 and 12. Children were grouped in five multi-age groups that did not necessarily reflect homogenous grade distribution. School activities throughout the 2016–2017 school period were documented through notes, e-mails, and other written documents, hundreds of pictures, and over 380 h video recording captured by up to 5 high definition cameras simultaneously filming different angles and aspects of the school and out-of-school

⁴ The experiences reported in this study stem from the engagement of one of us (Alfredo) as participant ethnographer. However, in order to preserve the collective endeavour that has gone into the conceptual and empirical analyses here presented, as well as our continued engagement in a larger research program aimed at better understanding and cultivating ecological approaches to learning (Damsa & Jornet, 2016), we avoid the use of the first person singular when possible.

activities. These data document over 200 sessions, divided in 4 main types of activities: *Group sessions*, typically involving a limited group of students, a teacher and an assistant working on a given subject or project; *collective school activities*, involving multiple groups and teachers simultaneously working on school-wide tasks or projects; *professional development sessions*, in which researchers and school staff together examined ethnographic materials collected through the project and used these as stimuli for reflective discussions and planning; and *Interviews* with school staff and students. Video materials along with the other ethnographic data were analyzed following *interaction analysis* procedures (Jordan & Henderson, 1995). The narrative presented below summarizes the main thread of inquiry, from the initial, abstract (partial) formulation of a research problem, to its concretization as a real, objective social object approached from an ecological perspective.

4.2. From indeterminate (abstract) to determinate (concrete) object of analysis: A narrative account of an emerging ecological unit

The research we describe here was first motivated by a growing concern in educational policy and literature to foster interdisciplinary and creativity-focused learner-centred curricula through the arts, despite a lack of research documenting the benefits and transformational impact often attributed to these pedagogies (Belfiore, 2011). We wanted to learn what arts-based education looks like in real practice, and the sort of learning dynamics and outcomes it may lead to. The school, which had been functioning for 6 years and was growing in popularity for its innovative arts-based approach, seemed like a perfect case for exploring these questions.

An abstract problem presents itself as an indeterminate object.

Through initial interviews and observations, it became increasingly clear that, despite the school's success and experience, it was difficult for us as well as for the school staff, to pin down and explicitly articulate just what the arts-based approach of the school was as a determinate object; neither as concept, nor as practice. As concept, it was easy to find diverse definitions articulated among the members, the statement that "it's taking each of the subject areas and infusing arts within it" (interview, Autumn 2016) being common. But, being absolute novices, this was not enough to guide our praxis, neither as researchers nor, most importantly, as participants. The question was not only what sort of thing we should focus our attention on so as to be able to say something coherent and reliable about arts-based education. The most pressing question was, simultaneously, how were we to orient in the setting, as observers and as participants, so as to sensibly and coherently understand and come to take part of the school's everyday practices?

One of the first times that our object of study emerged before us as a recalcitrant, objective fact, was during a science class, where one of us was assisting one of the new teachers. The teacher was to present the students with a science project, which would mean an opportunity for the group to implement some of the project-based, learner-centred school's agenda, and for us to finally observe such sort of activities. Few of the students in one of the round tables, however, began being noisy and were not paying attention or partaking in the lesson. At some point, and despite the pre-established, conscious intentions on our part to facilitate a learner-centred environment, the researcher/assistant found himself enforcing students' attention in ways that were directly opposed to those intentions—including threatening with punishment and persuading students to abandon ideas of their interest in pro of the pre-established scientific topic. At the moment, we were fully aware of these intentions and of the fact that we were acting counter to them. But, in a very embodied way, we felt unable to refrain or taking different approaches.

This was an inflexion point, for it showed us that, despite opinions or intentions, there were real forces, including our habits and/or inability to master the situation so as to turn it into a controlled situation, that threatened our implementing the very object we wanted to investigate. The realization was not just intellectual; it was felt as highly distressful. And, as we began to become familiar with colleagues, the feeling was not only ours, but was shared among several of the newer staff, who also felt frustrated as they failed to achieve creative and learner-led dynamics, often leaning back into more enforcing and rigid forms of teaching-learning. The situation became the more puzzling when, at the same time, we could observe how other more experienced members managed to sustain creative activities, merging subjects with performances, apparently drawing students with them without much trouble. What was happening? What were we failing to see or understand?

An indeterminate situation turns into a more coherent whole in and through concrete inquiry.

What was first experienced as an indeterminate situation began to emerge as a more coherent whole only after time and inquiry, as we became familiar with the type of relations that characterized the setting and their history. As it turned out, we found out that the fact that the school had shifted to a new location had resulted in a number of unresolved challenges that were now playing out as latent tensions in the schools' everyday relations, at multiple levels.

Right before the school year began, the small but growing school was in the process of moving to a bigger location. Funded just 6 years before as a kindergarten, the school had been steadily growing into a primary school, one grade per year, and was at that time offering a K-6 program.⁵ During the last few years, the school had been running its activities at leased premises that were shared with a larger organization, meaning that the school had permanent access to a limited set of spaces—3 medium to large rooms for everyday classroom activities—and temporal access to others—such as a large gym or a theatre stage. With the increasing number of students and staff, a larger space was needed. An entire building with several separate rooms, two large theatre areas, a kitchen, and outdoors area was leased, which offered the space the school needed for the current and coming years to continue growing. As it turned out, this change would tremendously alter the school's implementation of its arts-based, learner-centered curriculum. Of course, neither we nor the rest of the school's staff could know just how much and in which ways this was going to be the case when our research began. It was only with time and practice that the implications of this move were to emerge as objective conditions.

Importantly, there appeared to be a difference between new and "old" staff in the terms the participants used to account for this

⁵ As per 2018, the school has continued growing and offers now a K-8 program.

difficulty. For staff who had been working and embodying the school's practice longer, it was difficult to articulate the school's approach precisely because it was just what they did, and apparently there had not been a need to articulate it before. One of the more experienced staff put it this way: "It's funny. Hard to pull it apart cause it's just how I think, you know?" (Interview Autumn 2016). For the new staff, by contrast, the problem had to do with a lack of knowledge and experience on how to implement such an approach, specially given what they perceived as students being prone to make their teaching more difficult than in other schools they had worked before. New staff put it the following way: "well it's hard to get creative and have these freedoms, when you can't get the kids to sit still and organized to begin with" (Interview Autumn 2016). This difference was not just intellectual, but also affective, with comments like the above exhibiting distress and frustration. For the "old" staff, the affect was one of *yearning* for the previous satisfactory experience: "I think that I'm still yearning for that small school magic. There is something very special about the one room, two or three teachers" (Interview Spring 2017).

Working in a shared space had made it possible for the school's staff to implement a creative-oriented, interdisciplinary arts-based curriculum without standardizing or documenting many aspects of their practice, making it highly flexible. Although they needed to plan activities, working in a shared space allowed them to quickly improvise and adapt their planned tasks to emergent ideas or events, facilitating a more student-centred approach. Because of this flexibility, the interdisciplinary nature of their activities was also easier to implement. In addition, in that smaller environment, new staff could be trained just by joining, since they could learn vicariously, as all school activities were accessible across just few connected rooms.

In the new building, and with a larger number of students and groups, the teachers were working in separate rooms and the schedule had become more imposing. Changing the schedule on the spot no longer was possible since one could not coordinate with the other teachers, a situation that also demanded more planning for the interdisciplinary approach. Not having faced or foreseen this situation before, the school had not prepared an integral training program and so new staff had difficulties to understand and implement the school's philosophy. For them, the school's practice appeared as abstract and indeterminate as it did to us. The students, too, had been used to the school's prior flexible dynamics, having developed expectations that not always were met in the current space/organization.

A unit finally: Understanding the object in and through transforming it.

As we began to become aware of this emerging plot—through experience, interviews, and preliminary analyses of selected videos—we realized of the convenience of organizing *collaborative inquiry* sessions in which our findings could be shared with the rest of the staff. Very much in line with current *formative intervention* practice in educational research (Penuel, 2014), we organized these sessions as a means to facilitate, for the staff as well as for ourselves, developing ways of grasping our own everyday practices and how they could or could not be seen as learner-centred, arts-based education. This process, which involved regular meetings, led to a greater awareness of the school's challenges and needs, as well as to a transformation process in which practices evolved and changed as the school community strived towards a smoother, well articulated learner-centred teaching practice.

Along the process, we became aware that both most of the felicitous and most of the most challenging situations that we experienced had to do with the concrete, situated work involved in leading and facilitating subject-oriented tasks in ways in which there were conscious efforts to make room for emergence and the exercise of creative freedom on the part of the students. In abstract terms, this is simply a definition of learner-centred pedagogy. In the situated and concrete work of performing it, this means an active relation with an end goal or motive that evolves as efforts are made to actually perform it. Thus, through actively orienting to the goal of arts-based education, both the empirical object and how we related to it began to change. We became aware of the need of re-examining routines, habits, organizing tools and other environmental conditions that had allowed arts-based pedagogy to flow in the previous building to the new material conditions. Many of the latter conditions and tools were and are currently being re-designed, including a re-organization of the schedule, where subjects have been merged together to facilitate interdisciplinary teaching, or a reorganization of the use of the school's spaces so as to increase the time diverse groups and teachers spend together. Orienting concepts that had emerged as part of the school's philosophy—such as the motto "embracing change"—evolved and acquired new meanings. The role of the arts, too, was reconsidered, as we began to understand that some of the more powerful aspects of infusing arts stemmed not just from the creative character of the tasks but also from the children becoming literate into specific artistic *disciplines* that have a regulating character (Jornet & Roth, 2019).

5. Discussion

In the previous section, we present a narrative about how a particular object of study, the learner-centred, arts-based education practices in a primary school, unfolded from an initial formulation of an abstract problem, to the formulation of a concrete, historical object that had a definite—though changing and fluid—form or structure. In this section, our aims are to make salient how different moments in the narrative portray implications deriving from a meta-theoretical ecological approach to unit of analysis, and to position our contribution with respect to existing literature discussing unit of analysis.

We begin by restating the ecological position. Contrary to linear understandings of research practice, where units are supposed to be formulated prior to actual investigation, ecological units denote evolving social wholes that are not pre-established but found in and through inquiry. What is general about them is not a set of formal attributes but the ecological principle that "sees man-in-action [*sic*], not as something radically set over against an environing world, not yet as something merely acting 'in' a world, but as action of and in the world in which the man [*sic*] belongs as an integral constituent" (Dewey & Bentley, 1949/1999, p. 114). These social wholes or objects come to be known in and through active engagement with them, in a process in which observer and the thing observed mutually shape each other, a process which can be referred to as of *correspondence* (Ingold, 2013). As the outcome of a conceptualizing process (Säljö, 2009), our unit was not constituted through abstraction in the formal sense, but through the

(intellectual, affective) work of actively engaging with a particular historical form of teaching and learning.

In our analyses, we exhibit how what might formally have been conceived of as an object or thing objectively existing out there and ready to be studied, became an object of study in and through the concrete and material work of trying to understand it. In the case described above, the practices to be studied presented themselves first as a problem, as an object in-the-making, which hardly could be separated from the researchers and participants, or from the lives of others who, by taking part of its historical development, had grown habits and affectively-laden ways of orienting within it. The dynamics characterizing the teaching and learning practices described above involve a changing process of mutual attunement (Gibson, 1979) of expectations and anticipations, where students and teachers come to develop diverse attitudes and expectations about everyday school participation. As the physical (school) setting changed, transforming constitutive conditions for the continuation of praxis (the ways the rooms were divided, the schedules planned and implemented, etc.), priority developed mutual, organic attunements, when embedded into a new setting, led to tensions and contradictions, which manifested affectively and played out differently for old and for new staff.

In order to capture the “essence” of the school's teaching learning practice, the nature and principles that governed its change and development as a changing environment that in changing changed the lives of those involved in it, we formulate our unit of analysis as *the work involved in leading and facilitating subject-oriented tasks in ways in which there were conscious efforts to make room for emergence and the exercise of creative freedom on the part of the students*. With this, we do not wish to denote a particular situated action or set of actions, which can then be abstracted from one situation and applied to many other such situations. This would be what Vygotsky (1987) referred to as analysis by elements. Rather, we mean to denote the social, historical object that develops, in our case, from the beginning of a small school enterprise into a bigger school, and in doing so, transforms its own challenges, values and the forms of individual experience that this particular social practice affords. In a broader historical context, this same social object exists or manifests as a changing societal form of organizing progressive education. And because the ecological logic demands a genetic explanation, our unit of analysis denotes the social germ-cell that primarily drives this historical practice's development.

If, in line with common formulations in educational research textbooks, we had formulated our unit of analysis as consisting of the institutional context, we would have only partially addressed the inquiry problem. For, although we observe that, in the case presented here, it was in and through changing institutional tools and routines that participants sustained and transformed their practices, this does not yet account for how or why changes were motivated in the first place. In our view, such an account requires describing the uniquely internal dynamics that make given historical practices the practices they uniquely are, as oppose to describing practice in general, which would apply to any other practice. While all human practices may be described as involving institutional aspects (and social and individual as well), this does not yet tell us what our object is as an object growing and leading to growth in a given ecology. There is, therefore, confusion between the notion of unit and that of levels of analysis. In this regard, our unit of analysis existed at the individual as much as it existed at the group and the institutional levels. More so than institutional, it was *historical* in the sense that it emerged and evolved as a self-developing ecosystem of relations, manifesting within each person and as relations between people within institutions.

In order to understand the internal coherence of the whole under study, as a unit in the Vygotskian sense describe above (unit analysis vs. analysis by elements), our formulation of a unit aims to capture the historical, ever-changing process through which people purposefully work with the goal of achieving teaching-learning relations that allow creative freedom while developing disciplined competence. This requires of an intellectual but also affective process that includes becoming engaged with the praxis in motive-oriented ways. As the analysis above show, the internal logic and coherence of the (social) whole being studied becomes first empirically available not as an abstraction, but as a lived-through tension—manifesting as frustration some times, as joy other times—that results precisely from purposeful engagement in practice.

In this regard, our position is not opposed to the idea of *object-oriented activity* (Engeström, 2001; Leontyev, 1977), or to the notion of too-mediated action (Wertsch, 1998), both having been suggested and adopted as units of analysis in current learning theory. We have in fact shown how core aspects emphasised in the later theories, including rules, the tools, and the orientation of participants to historical motives, as mutually transforming each other through the school's activity development. But our contribution adds to these formulations a call for the need to not only describe the formal elements that can be identified in each and all activities (that they all include given elements such as tools, rules, etc.), but also come to terms with the specific germ-cell forms that characterize distinct activities, and not just all activities. The ecological meta-theoretical framework describe here does not contradict but qualifies the use and value of notions such as activity or tool-mediated action, recognizing them as meta-statements rather than as units themselves. The ecological framework here presented demands identifying, through inquiry, units that denote flexible, developing and concrete wholes, rather than abstract, general but fixed units.

As a concrete object of analysis, the learner-centred, arts-based teaching practices that we investigate are not “activity” in the abstract, but specific, historically developed activities, the fabric of which is made of the lives of particular individuals joining together in common future-oriented life *projects* (Blunden, 2014). In the case described above, as we struggled to understand and become competent participants of the school's practices, no pre-established conceptual abstraction helped. Faced with the real task of collaborating with teachers and students to carry on arts-based teaching practices, the sort of knowledge that allowed us to meaningfully participate was given to us in and through vital *experiences*—of enthusiasm, disappointment, joy, and frustration—as we strived to help getting tasks to flow in ways that we perceived worthy. In occasions, at the beginning of the project, and despite our training in pedagogy, we would find ourselves correcting or scolding children in ways that were counter to our own beliefs and conscious goals. It was only as we began to understand our task as one of practically, affectively, and intellectually orienting to situations as occasions to facilitate subject-oriented tasks in ways that would allow for the students' to orient and lead the activity, that we began to feel competent. It was the work oriented to making our joint goal explicit and to achieving it practically what constitutes a unit or germ-cell, for it was the key not only to meaningfully participating, but also to further transforming and

expanding the school's activity.

Through our analyses and discussion, we have made salient how, when units are arrived at from an ecological perspective, they not only emerge from inquiry, but also institute the conditions upon which new experiences are had and therefore upon which new inquiry can begin. The very project of trying to understand the school's practice led to the formulation of new tools and ideas, which are currently being developed in actual practice, leading to possibilities for further inquiry. Researching from an ecological perspective thus involves an ethical, moral dimension in which science and politics co-exist. In our ethnography, our inquiry did not end up with the formulation of a definition or law concerning what arts-based education *was*, but rather aimed at understanding arts-based education as an open-ended project. The validity of our claims was grounded not only on our own experience, but also on that of others with whom we worked, thereby fulfilling current calls in learning science to ground rigor on relevance to practice (Gutiérrez & Penuel, 2014).

6. Concluding remarks: Ecological “social” units

Our goals in this study are to theoretically and empirically elaborate on premises and implications of an ecological approach to unit of analysis. It is not our intention, however, to argue that the only adequate research is that which takes an ecological stance aiming to address social aspects of learning. Approaches grounded on the classical formal approach described in section 3 are certainly important and necessary for the scientific advancement of our field. The ecological view described here does in fact restate many premises underlying existing sociocultural and situative views. Our contribution, however, goes an important step further in making more explicit the premises and logics upon which these theories rest in principle, showing how they can offer a definition of “the social” that is fundamentally different from the idea “larger than the individual” often mobilized in learning research literature.

Sociocultural and situative approaches are often defined by means of units of analysis that denote not the individual but some form of individual-in-cultural-context unit (Cole, 1996). In this regard, *mediated action* (Wertsch, 1998) or *activity systems* (Engeström, 2000) have been formulated as such units. The meta-theoretical perspective discussed here, while consistent with many of the premises exposed in those theories, further clarifies the underlying logic as well as brings with it implications on how to adequately (or at least consistently) use existing frameworks in ways that lead to distinct and valid scientific outcomes. Our contribution emphasizes the import of research moving beyond abstract formulations of unit of analysis and into formulations that concretize and better allow understanding what make different social practices different, and what the core dynamics are that drive their development across levels (individual, social, institutional, etc.).

This involves attending to learning and cognition phenomena as social practices in their own right, each with its distinctive character, instead of understanding their social character as stemming from the fact that individuals do things together and accordingly need to be studied with units larger than the individual. As our analyses show, however, even individual feelings and thoughts are immediately and genetically connected with societal situations, experiences, wholes, that characterize human life. In this regard, our contribution depicts a notion of the “social” that demands of researchers to formulate not abstract units of analysis based on pre-established definitions of what is social and what is not, but units arrived at by carefully attending to the dynamics of development of societal forms of learning, thinking, and feeling.

As Goethe wrote, finding the unit, germ cell or *Urphänomen* that characterizes distinct living developmental processes is the higher rather than the initial moment of research, a moment characterized by “astonishment”:

“The highest which man can attain in these [scientific] matters ... is astonishment; if the primary phenomenon [urphänomen] causes this, let him [*sic*] be satisfied; more it cannot bring; and he should forbear to seek for anything further behind it: here is the limit. But the sight of a primitive phenomenon [urphänomen] is generally not enough for people; they think they must go still further; and are thus like children who, after peeping into a mirror, turn it round directly to see what is on the other side” (Goethe, in Eckerman, 1906/2010, 1829, under *Wed., Feb. 18*, para. 2).

We would only add to this that units are “the limit” precisely in that they open for new inquiries. If sociocultural and situative theories are to continue being productive to transformational educational research and practice, then our inquiries cannot all end up re-stating that our unit of analysis is the social, but we need to take each of those units for what they are, that is, concrete historical practices of learning that need to be properly described; practices which are individual and social simultaneously, and which evolve and change along with the agency and responsibility of those who actively participate in changing them, including our responsibility as scholars and educators.

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