Abstracting Processes, from Individuals’ Constructing of Knowledge to a Group’s “Shared Knowledge”

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A model for processes of abstraction, based on epistemic actions, has been proposed elsewhere. Here we apply this model to processes in which groups of individual students construct shared knowledge and consolidate it. The data emphasise the interactive flow of knowledge from one student to the others in the group, until they reach a shared knowledge — a common basis of knowledge which allows them to continue the construction of further knowledge in the same topic together.

The relationships between the construction of knowledge by individuals and the “shared knowledge” of an ensemble is a fascinating issue, both from cognitive and socio-cultural points of views. An ensemble is defined as “the smallest group of individuals who directly interact with one another during developmental processes related to a specific context” (Granot, 1998, p. 42). The existence of an ensemble emerges from situations in which individuals contribute to the same activity.

Typical ensembles in classrooms include dyads, small groups, and entire classes. In each case the teacher may or may not be included in the ensemble. Understanding the relations between the construction of knowledge by individuals and what we will call “the constructing of the ensemble’s shared knowledge” is crucial in research concerning learning processes in the classroom, and evolves from the cognitive as well as the social domain. Several scholars (e.g., Simon, 1995) have invested effort into integrating these domains. Rommetvæit (1985) defined the term intersubjectivity to designate the set of common beliefs necessary to sustain an interaction, and Tomasello, Kruger, and Ratner (1993) elaborated the idea of shared understanding to explain why people attend to each other and reason together.

However, researchers who plan to observe and analyse, in detail, processes of constructing knowledge in an ensemble, within a context such as a classroom and over a period that may range from minutes to weeks, face great difficulties: the observation and documentation processes are complicated, and the data may be massive and messy. On the other hand, data on the behaviour of specific individuals may be sparse and there are no systematic clear-cut methodologies for analysing them (Schoenfeld, 1992). Some members of an ensemble might be
silent and seem passive even when they are attentive — a situation that Kuhn (1972) designates "tacit interaction." The difficulties become particularly acute as the size of the ensemble increases.

Many researchers have been aware of the above difficulties. In their efforts to analyse the collective learning of a mathematics classroom community, Cobb and colleagues (2001) focused on the evolution of mathematical practices. For this purpose, they combined "a social perspective on communal practices with a psychological perspective on individual students' diverse ways of reasoning as they participate in those practices" (p. 113). They discussed the notion of taken-as-shared activities of the students in the same classroom:

> We speak of normative activities being taken as shared rather than shared, to leave room for the diversity in individual students' ways of participating in these activities. The assertion that a particular activity is taken as shared makes no deterministic claims about the reasoning of the participating students, least of all that their reasoning is identical. (p. 119)

Voigt (1995) emphasises the role of interaction in arriving at taken-as-shared knowledge:

> Through their discussion, the students and teacher constituted an explanation that perhaps neither would produce individually. They arrived at knowledge taken as shared. (p. 183)

Voigt analyses interactions between students and their teacher as well as interactions among students. According to him, interaction mediates both psychological and social processes: Individual cognition and social constructs are both promoted through the mediation of negotiation for meaning.

In this paper, we focus on processes of constructing knowledge in an ensemble of three interacting students, where personal diversity, the unique nature of each individual, is observed and analysed. We will emphasise the flow of knowledge from one student to the others, until they have a common basis of knowledge. The research focuses on the constructing processes and on the constructs at a given point of time, as well as on their consolidation. If their common base of knowledge allows the students in the ensemble to continue constructing knowledge collaboratively and actualising it in further activities, we identify this as shared knowledge — a common basis of knowledge which allows the students in the group to continue together the construction of further knowledge in the same topic.

Our research is standing on the shoulders of others' research, such as that of Voigt (1995), Cobb et al. (2001), and many others; but it goes beyond theirs in several perspectives:

1. The micro-perspective: We provide detailed evidence of the group's shared basis of knowledge, the manner in which it emerges from the individuals' knowledge-constructing processes, and the way in which it constitutes a shared basis that allows the students to continue constructing further knowledge together.

2. The continuity perspective of the micro-analyses: We tie the data and