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Patterns of interaction and construction of shared mathematical meaning in classroom

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Background and introduction

My research with lesson data in a secondary mathematics classroom of Barcelona (Chico, 2014) drew on a sociocultural understanding of learning through talk-in-interaction to examine language use in situations that accomplish a mathematical discourse. In the tradition of symbolic interactionism, interaction is seen as a recursive process where individual actions are influenced and influence the interpretation of and response to the broader system of actions taking place in a given social context and time (Goffman, 1981; Krummheuer, 2007). Following Sfard (2008), student mathematical learning emerges through the practice of specific forms of discourse. Accordingly, I view the collective construction of the language of mathematics in classroom as an articulated process of individual actions of participants that have the opportunity to recognise, use and construct meanings in particular types of mathematical discourse. From this perspective, it is fundamental the study of social interaction in the midst of specific processes of collaboration, negotiation and construction of shared meaning in the mathematics classroom (Planas, 2014). This is why I examine class conversations among students and between students and the teacher and attempt to identify patterns of interaction as well as their impact on the production of a language of mathematics that can be interpreted as evidence of mathematical learning.

Lesson data and methods

My lesson data comes from the registration of class discussions in a sequence of five lessons with five problems about mathematical generalization. For each problem, the teacher introduces the task, and provides time for pair work followed by classroom group discussion. All problems consist of three successive moments of conceptual learning around: 1) Near generalization (work on particular cases that allow the use of drawing strategies); 2) Far generalization (work on particular cases that are not easily perceptual and allow the use of recursive strategies); 3) Algebraic generalization (work on an algebraic expression that represents the general case). In this way, there is increasing mathematical complexity in terms of the actions required to identify common generalizations that arise from the study of particular cases which are either numerical or geometrical. The application of constant comparative and inductive methods (Planas, 2004) served to reduce primary lesson data by producing related types of peer interaction and mathematical content. I looked for advances in the communication of mathematical content and for the types of interaction involved. In a more advanced stage of the research, and continuing with the application of similar methods of comparison, I came to some basic patterns of interaction made up of two consecutive types of peer interaction, both involved in the production of the language of mathematics during the discussion of a specific moment of generalization.

Some of the patterns of interaction produced

Based on the analysis developed, I can claim that some of the basic patterns of interaction constructed correspond to isolable situations of group and pair work with impact on the production of the language of mathematics of the learners. The mathematical product of these basic patterns functions as mediator of and contributor to the mathematical language in use during the resolution of the task. Overall, mathematically relevant moments of group interaction can be

de-constructed through basic patterns of interaction and a number of regular compositions among them. Despite the fact that the constitutive parts of a basic pattern tend to be contiguous, this is not always the case and exceptions may need further investigation. There are situations where, between the first and the second components of a pattern (e.g., ‘Initiating’ and ‘Sharing’), there is another basic pattern of interaction (e.g., ‘Initiating’, ‘Querying’ and ‘Sharing’) inserted or situations where several basic patterns are noticeable (see them and the detail of the research in Chico, 2014). Figure 1 illustrates three of the most frequent basic patterns found (first line in blue) in relation to the mathematical content underlying (second line in orange) that came out of the analysis. On the other hand, the composition of these basic patterns also seemed to play a role in the development of mathematical learning, particularly numerical and algebraic thinking.

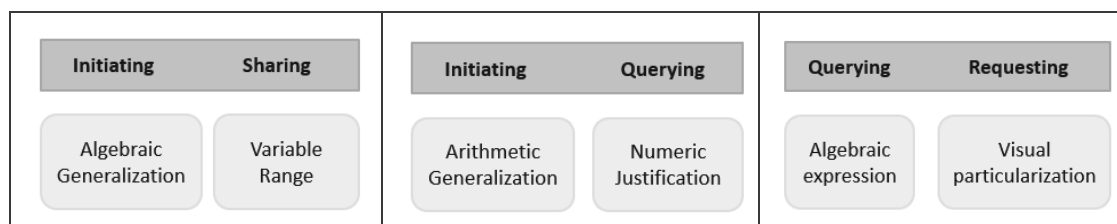


Figure 1. Empirically-based examples of basic patterns of interaction

More generally, an interesting outcome of this research is the fact that shared meaning constructed in group discussion is produced as a non-consecutive process, with several turns in-between the development of specific mathematical reasoning and direct pairs of question-answer often being quite far in time during one same lesson. Hence, the production of the language of mathematics seems to be complex in terms not only of collaboration and of negotiation of meaning, but also due to discontinuities and interferences in the interaction and communication during group discussion. This sort of discontinuities are worthy of further study, for they may indicate the need to revise mathematical interaction and communication in more dialectical terms.

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