REASONING AND PROOF IN CLASSRROM (9TH GRADE)

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ABSTRACT. This paper is research oriented and pretends to contribute toward giving empirical evidence about how students develop their reasoning and how they achieved to a proof construction in school context. Its main theme is epistemology. It describes the way in which four students in 9th Grade explored a task related with the discovery of symmetry axes in various geometric figures. The proof constructed by students had essentially an explaining function and it was related with the symmetry axes of regular polygons. The teacher's role in meaning negotiation of the proof and its need is described through illustrative episodes. The paper presents part of a study which purpose is to analyse the nature of mathematical proof in classroom, its role and the nature of the relationship between the construction of a proof and the social interactions. Assuming a social perspective, attention is focussed on the social construction of knowledge and on the structuring resources that shape mathematical experience. The study's methodology has an interpretative nature. One outcome of the study discussed here is that students develop first a practical understanding with no awareness of the reasons founding mathematical statements and after a theoretical one leading them to a proof elaboration.

Theoretical issues

The study's framework is rooted in the theoretical frame of activity theory in the line of Vygotsky and Leont'ev. Drawing on a vygotskian approach, Wertsch (1991) uses the bakhtinian construct of 'voice' to emphasise the social origins of individual mental functioning. The process whereby one voice speaks through another voice in a social language is termed 'ventriloquation' by Bakhtin (1981). So there is a certain interference of one voice on another accompanied by a partial and correlative subordination of the last one.

Mathematics learning is seen as a situated phenomenon (Brown, Collins, & Duguid, 1988; Lave, 1988; Wenger, 1998). As the school context plays a fundamental role, it is not possible to separate activity, people acting—and respective interactions—and the artefacts that mediate that action. All those dimensions are intrinsically interwoven. The study draws also from embodied cognition perspective (Lakoff e Núñez, 2000) assuming that mathematical concepts are structured by the nature of our bodies and the particular way we function in the world.

Knowledge is not independent of the situation in which it is produced. If situation is structuring of cognition, then we can assume also that knowledge and activity are inseparable and mutually constitutive. The centrality of activity in cognition constitutes the base for study theoretical background. It is the mutual interaction between acting and knowing that shapes one another reciprocally (Rodrigues, 1997). Cognition includes the use of representations but is not based on them. The emphasis falls on the notion of action and the relationship between the subject and the world is redimensioned: the subject and the object, that is, the interpreter and the interpreted define one another simultaneously and they are correlatives (Varela, 1988/s.d.); they are not independent nor are separate entities as assumed by the rationalistic perspective.

The proof is inherent to the nature of mathematics as a science. So the study focus the mathematics philosophy discussing questions as the nature of mathematical objects, the relationship between the experimental reality, the natural and human world and the mathematics, how is seen the truth and what can rely it. The study discusses the epistemological status of proof, assuming mathematics as a human and social construction, but non-arbitral. It is this non-arbitrary that explains the parallelism between the physical reality and the mathematical one (Hersh, 1997). In the line of Ernest (1993), the mathematical knowledge develops through conjectures and refutations (Lakatos, 1994) and relies on linguistic knowledge, conventions and rules.