ON THE EPISTEMOLOGY OF INTEGERS

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ABSTRACT

This paper discusses the solutions of Freudenthal [1973, 1983] and Dienes [1972] of the sign rule problem. It offers an alternative solution based on three games, intended to solve *in action* the four didactic problems: *How to take the bigger from the smaller? How to subtract a negative? What does "minus-times" something mean? Why does minus times minus equal plus?* The reduction of the didactic problem to these four questions is justified by an epistemological analysis from the point of view of reflective abstraction and completive generalization. Some results of uses of the games are reported. The didactic strategy is justified in terms of the theory of situations [Brousseau, 1983, Margolinas, 1992] and the theory of conceptual fields [Vergnaud, 1990, Coquin-Viennot, 1985]. Difficulties in analyzing research data in the framework of these theories is discussed. A new theoretical framework based on the concept of *production of meaning* [Walkerdine, 1988] and of *semantic fields* [Lins, 1992] is introduced and an epistemological discussion of the sign rule and of the multiplication structure of integers is retaken. The conclusions shed light on students' difficulties with the sign conventions in the teaching of physics [L. Viennot, 1980].