Epistemological and institutional study of algebra in secondary school: the semiotic, semantic and syntactic point of view

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We present the results of an epistemological study on teaching and learning of equation, inequation and algebraic function in secondary schools. Two didactical analyses are made: the first, which is of historic-epistemological nature, covers the mathematical evolution of semantic, syntactic and semiotic dimensions; the second, which is of institutional nature, is dedicated to the curriculum and programs exploration of manuals with the aim of decrypting the didactical characteristics and scopes.

Keywords: Equation / Inequation, Syntax, Semantics

Research problem

Our study is related to the research that has generally focused on the difficulties of rupture from arithmetic to algebra, Chevallard (1984, 1989), Kouki (2006) and Coulange & Drouhard (2012).

In this research paper, we hypothesize that the semantic and syntactic dimensions, which are introduced in the semantic logic by Tarski (1960), developed by Quine (1972) and used in the didactical research of Selden & Selden (1995), Durand-Guerrier & Arsac (2005) and Kouki & Chellougui (2013) at the level of semiotic representation Duval (2006), could better explain the mathematical conceptat the level of its internal transposition process.

Analysis grid

We will present our model of an analysis grid developed via crossing three tools of training analysis from which we started our investigations in terms of external transposition. The analysis of Tunisian mathematics curricula and textbooks of the second-year science class (of 16-17 -year-olds) showed an absence of articulation between curve, equation and algebraic function[1].

Historical and epistemological investigation

We outline the object of equation, inequation and algebraic function by an historico-epistemological analysis of different types of techniques that has contributed to the genesis of this concept of knowledge from ancient times through the Greek and worked until the Arab algebra.

Didactic investigation

Thereafter, we will present the principal results of an analysis of algebra teaching program and the unique Tunisian teacher's book to confront different logico-mathematical dimensions found in the historico-epistemological study of mathematical knowledge with those mobilized in its current teaching. However, our study is based on the results of educational works in the field of teaching

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[1]For example the parabola curve and the equation of the parabola y = ax2+ bx + c and the function

f : x→ f(x) = ax2 + bx + c than a≠0.

algebra, which also showed the contribution of this study in terms of registers of semiotic representations of mathematical object, in the vein of Duval and used in Kouki (in revision).

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