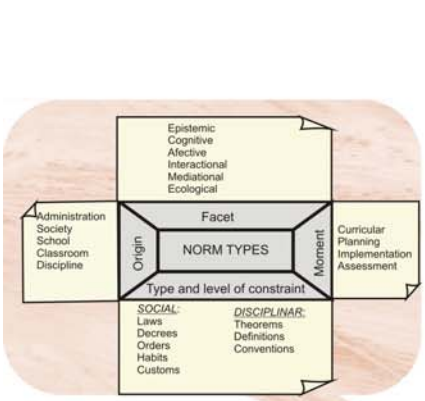
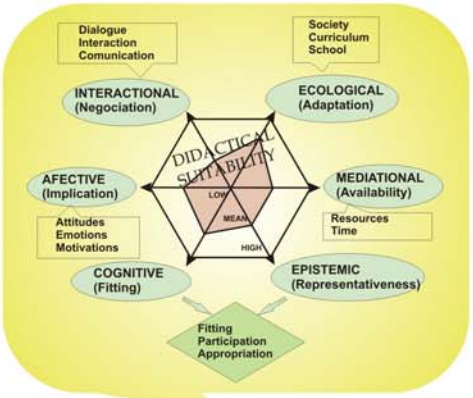
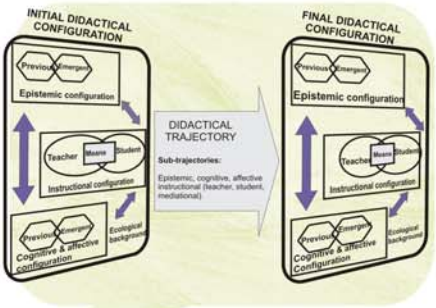
THE ONTO-SEMIOTIC APPROACH TO MATHEMATICAL KNOWLEDGE AND INSTRUCTION

An integrative theoretical framework to research in Mathematics Education

Juan D. Godino[(1)], Carmen Batanero[(2)] and Vicenç Font[(3)]







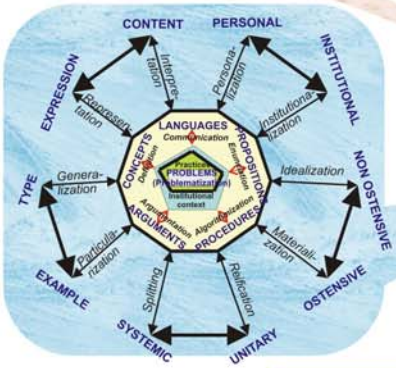
DIDACTICAL SUITABILITY

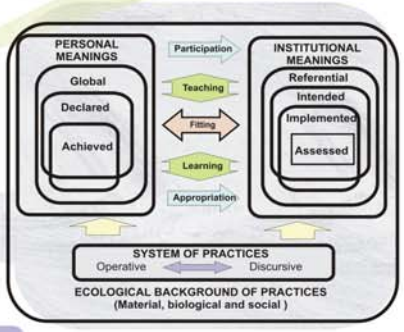
NORMATIVE DIMENSION

DIDACTICAL TRAJECTORIES

CONFIGURATION OF OBJECTS AND PROCESSES

SYSTEM OF PRACTICES





Critic mathematics Ed. (Skovsmose)

Socio-mathematical norms (Cobb/Voigt)

Didactical situation theory (Brousseau)

Conceptual fields theory (Vergnaud)

APOS Theory (Dubinsky)

Didactical phenomenology (Freudenthal)

...

Semiotic R. Registers (Duval)

Cultural objectification theory (Radford)

Socio-epistemology (Cantoral/Farfán)

Anthropological theory (Chevallard)

Ethnomathematics (D'Ambrosio)

PEIRCE | WITGENSTEIN | VIGOTSKY | HABERMAS | MORIN

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Teoria-edumat virtual forum:
http://es.groups.yahoo.com/group/teoria-edumat/

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Onto-semiotic approach Blog:
http://enfoqueontosemiotico.blogspot.com/

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An Integrative Theoretical Framework for Mathematics Education

THE ONTO-SEMIOTIC APPROACH TO MATHEMATICAL KNOWLEDGE AND INSTRUCTION

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The Onto-Semiotic Approach (OSA) is a theoretical framework that adopts semiotic and anthropological assumptions about mathematics, and socio-constructivist and interactionist principles for the study of teaching and learning processes.

The OSA was started by the "Theory of Mathematics Education" Research Group at the University of Granada (Spain) in the beginning of the nineties, and is now developed and applied by others Spanish and Latin-American research groups. The set of theoretical notions that at present compose OSA are classified into five groups, each of them allowing specific level of analysis for the teaching and learning processes of particular mathematical themes:

(1) *System of* (operative and discursive) *practices.* Here we assume a pragmatist – anthropological conception of mathematics, both from the institutional (socio-cultural) and personal (psychological) viewpoints. Problem solving activity is considered as the key element in the construction of mathematical knowledge.

(2) *Configuration of mathematical objects and processes* that emerge and intervene in mathematical practices. An interactionist notion of object and a pragmatist view of meaning (content of semiotic functions) allow to articulate coherently the anthropological (Wittgenstein) and realistic positions (not Platonist) of mathematics. The diverse means of expressions (language) fulfill the double role of instruments for mathematical work and representation of mathematical objects.

(3) *Didactical configuration*, conceived as the articulated system of teachers' and students' activity when interacting within a configuration of mathematical objects and processes linked to a problem–situation, is the main tool to analyze mathematical instruction. Didactical configurations and their sequencing in didactical trajectories take into account the different facets or dimensions that characterize the mathematics teaching and learning processes: that is, the epistemic (institutional knowledge), cognitive (personal knowledge), affective, mediational (technological resources and time), interactional and ecological dimensions.

(4) *Normative dimension* is the system of rules, habits, norms that restrict and support mathematical and didactical practices, and which generalizes the notions of didactical contract and socio-mathematical norms. These norms and meta-norms intervening in the diverse facets of mathematical study processes are explanatory factors for didactical phenomena.

(5) *Didactical suitability* is defined as general criteria of adaptation and appropriateness of the educational authorities' students' and teachers' actions, as well as of the knowledge and resources used in a specific study process. The system of empirical indicators identified in each facet is a guide for the analysis and systematic reflection that provide criteria for the progressive improvement of teaching and learning processes.

The Onto-semiotic Approach allows a coherent articulation of diverse theoretical models usually applied in Mathematics Education research (didactical phenomenology, ethno-mathematics, anthropological theory, didactical situation, conceptual fields, semiotic representation registers, socio-epistemology, etc.)