

# **The Use of Microworld to Improve Ninth Graders Concept Image of a Function: the Triple Representation Model Curriculum**

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## **Abstract**

The constructivist theory, as a theory of learning which has roots in developmental psychology (von Glasersfeld, 1983), has been adopted by several educationalists (diSessa 1985; Thompson 1987) as a basis for the construction of whole curricula. However, the model of construction remained theoretical and had to be applied and checked. The "Ingenierie Didactique" is a methodology whose aim is precisely to apply cognitive principles compatible with constructivist theory in didactical terms, and to check in the classroom whether these theoretical objectives are attained. We adopted this methodology to construct a curriculum for the function concept: in the first half of the doctoral dissertation we describe the epistemological, didactical, and cognitive results relevant to this purpose. The role of representation, its significance for the student and the transfer between these representations are here the central topics. The curriculum generated from these principles consists of:

- a computerized environment (a microworld), the Triple Representation Model built of operations about the function concept;
- a sequence of problem based activities.

After the stage of application, we first checked, with a conventional Achievement Test, if the objectives had been attained. But although the results were very positive, a well-constructed microworld gives good methodological opportunities to understand cognitive mechanisms. We constructed a computational model to measure the occurrence and nature of transfer between representations. A variety of tools (interviews, dribble files, manipulation of the software,...) enabled us to deepen the study of some of the mechanisms involved, during and after the learning process. The design of the construction of the curriculum, the construction of the software, the research tools and their computational analysis, seem to be an archetype for the description and the evaluation of learning processes involving computerized environments.