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A von Neumann- based Teaching Model to observe the difficulties of learning natural numbers with students 6 -7 years old

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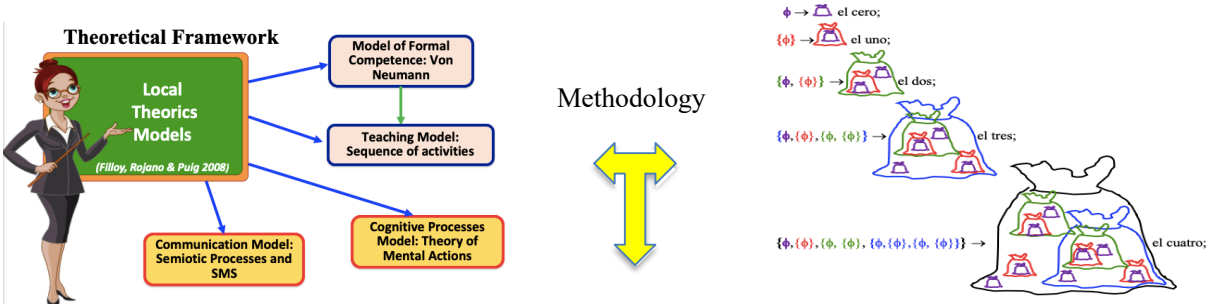
The starting point of this research is that learning difficulties of arithmetic that children from 6 – 7 years old have, are in the mathematics itself. With the Theoretical Framework of Local Theoretical Models and its four components (Formal, Cognitive, Communication and Teaching) a Teaching Model was designed with Von Neumann's formal mathematical basis, to identify difficulties in the construction of natural numbers including zero, using iteration, recursion and the concept of successor.

RESEARCH PROBLEM

In Mexico in elementary school, the treatment of numbers is centered on cardinality, with actions of comparison, equalization, counting of numerical sequences starting with the number one, the construction of the successor is not worked. The number zero is presented as a figure to indicate the empty column in quantities: 10 or 105. The **objective** of this research is to identify difficulties in constructing natural numbers, including zero from von Neumann's formal mathematical analysis in children aged 6 to 7 years.



Design of Teaching Model: Von Neumann's mathematical structure (Hamilton & Landin, 1961, pp. 76-99) is translated into Mathematical Principles and then into sequences of activities. Teaching Model *Experimentation*. *Design of categories* based on the formal, cognitive and communication components to analyze the experimentation of the teaching model.

Results

Identification of recurring difficulties: Zero as a number, as an empty set, and as the origin point on the line. The number zero is the only number that is not a successor and belongs to any successor. Use the resource process for successor construction.

In conclusion: Overcoming the difficulties of constructing zero and its successors with the use of iteration and recursion are the basis for a transition towards the generalization of the natural numbers, discovering in the process some of their arithmetic properties.

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