Research on school algebra. From didactic transposition to instrumental genesis

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Research on school algebra: 1979-2016

First studies in the 1980s, by Y. Chevallard, in an attempt to approach secondary school mathematics from the perspective opened by the Theory of Didactic Situations

This gave rise to the first analysis in terms of didactic transposition that later became the Anthropological Theory of the Didactic

Other frameworks have also been developed in a close relationship to research on school algebra, like the semio-linguistic approach (J.P. Drouhard et al, F. Arzarello et al) and the Theory of Instrumentation (L. Trouche et al)
Recent surveys: 2012 and 2015


- 16 papers
- Part 1: Teaching algebra practices
- Part 2: Cross-perspectives on the algebra to be taught

Research on school algebra: 1979-2016


<table>
<thead>
<tr>
<th>Year Range</th>
<th>Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1990</td>
<td>9</td>
</tr>
<tr>
<td>1991-2000</td>
<td>12</td>
</tr>
<tr>
<td>2001-2010</td>
<td>25</td>
</tr>
<tr>
<td>After 2010</td>
<td>23</td>
</tr>
</tbody>
</table>
What is taught as “school algebra”? What is (not) taught? What was taught/considered as “school algebra” before?

**DIDACTIC TRANSPOSITION**

Vanishing of algebra in current curricula: not systematic work on algebraic expressions with parameters and disconnection with quantities and functional modelling.

**INSTITUTIONAL CONSTRAINTS (ECOLOGY OF KNOWLEDGE)**

Lack of sense/rationale of many algebraic handlings. Pejoration of algebra (writing) in Western cultures. Need for a debate about (and renew of) what mathematics should be taught at secondary school.
Research questions and approaches (2)

What algebra could be taught? Under what conditions? How to implement them? What constraints are found?

→ REFERENCE EPISTEMOLOGICAL MODELS (REM)

“Computation programmes” as a basic notion to rebuild and give meaning to algebraic notions and activities. New interactions between the algebraic and numerical work (e.g. negative numbers) and functions.

→ DIDACTIC ENGINEERING (NEW ECOLOGIES)

Experimentation of teaching sequences using ICT. Conception of computing environments in collaboration with computer experts. Potential errors and students’ trajectories using REM.
Research questions and approaches (3)

How do ICT modify the nature and the way of using, teaching and learning algebra?

→ CONCEPTION OF ICT AS PART OF THE ADIDACTIC MILIEU
  ICT environments are integrated to algebraic activities
  Importance and nature of their feed-back

→ TAKING INTO ACCOUNT THE INSTRUMENTAL GENESIS
  Problems of integration and teachers’ legitimacy

→ DIDACTIC AND COMPUTER TRANSPOSITION
  Design of new ICT environments (APlusix and Pépite)
  based on explicit epistemological models of algebra
Research questions and approaches

How to teach algebra?

What is taught as “school algebra”? What is not taught? What was taught/considered as “school algebra” before?

What algebra could be taught? Under what conditions? How to implement them? What constraints are found?

How do ICT modify the nature and the way of using, teaching and learning algebra?

How to overcome students’ difficulties with algebra?

DIDACTIC TRANSPOSITION

ECOLOGY OF KNOWLEDGE

REFERENCE EPISTEMOLOGICAL MODELS (PRAXEOLOGIES) ...

DIDACTIC ENGINEERING

INSTRUMENTAL GENESIS

DIDACTIC MILIEU

INSTITUTIONAL LEGITIMACIES
In Memoriam: Jean-Philippe Drouhard

A research life in didactics devoted to the study of the semio-linguistic complexity of elementary algebra
