Learning Beginning Algebra in a Computer Intensive Environment (CIE)

Thesis for the degree
DOCTOR OF PHILOSOPHY

Submitted to the Scientific Council of the
Weizmann Institute of Science
Rehovot, Israel

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August 2007

Abstract (Press here for full text)

The goal of this dissertation is to advance our understanding of the learning and teaching of beginning algebra in a Computer Intensive Environment (CIE). A pilot study, consisting of an in-depth analysis of how a pair of 7th grade students constructed their knowledge over time, suggested the potential advantages of learning in CIE. which has the following characteristics: (1) computerized tools are available at all times both at school and at home, and (2) students are free to choose if, when, and how to use the tools, in order to work with (3) carefully designed learning materials. The main body of this dissertation consists of scholarly papers describing the following:

- the design and implementation of the innovative environment,
- the research questions chosen to pursue,
- the research qualitative methodology (with quantitative aspects)
- the findings that document and analyze students' learning processes and outcomes including achievements (and comparisons to two kinds of control groups), instrumental genesis processes, and classroom socio-mathematical norms), and
- a discussion of the main findings, their generalizability, limitations, and questions for further research .

Overall, it was found that students meaningfully learned (1) content (they outperformed the average student on a national exam), (2) learning skills

(posing conjectures, choosing strategies, representing situations, organizing data, monitoring solution processes, and reflecting), (3) different ways to support their own progress by harnessing the characteristics of a computerized tool (from which they could wean themselves by the end of the year), and the context of inquiry, and (4) to respectfully discuss mathematical ideas with peers and to generate mathematical questions for themselves. Students' transition from arithmetic to algebra was gradual, and was at an individual pace.

The work presented here is organized in five chapters. The first chapter includes an introduction and a literature review. The second chapter includes design, methodology, and research questions. The third section consists of the papers. The fourth chapter summarizes (from the different papers) the answers to the research questions. The fifth chapter presents the discussion, conclusions, and the theoretical and practical implications of the study.