Investigation of the Effect of Assignment Projects on Mathematical Activity of Graduating Junior High School Students

Thesis for the degree Doctor of Philosophy by Nurit Zehavi

Submitted to The Scientific Council

The Weizmann Institute of Science

Rehovot, Israel

November 1984

Abstract

The object of the work described in this thesis is to explore and enhance student mathematical activity in open problem solving situations. The initial efforts drew their inspiration from Polya's work on heuristic learning. The learning models have their source in Skemp's ideas of intelligent learning and teaching.

In the first place, assignment projects for 9th grade students were developed within a framework of cognitive and cogno-affective goals. An assignment project is an open-ended mathematical problem, whose scope is wide but is integral to the core curriculum.

Studies were carried out to investigate whether in fact the material elicits the desired goals. This was followed by an evaluation of its effectiveness in enhancing student mathematical activity.

Based on the Skemp model a framework for qualitative evaluation of mathematical activity was developed. Student responses were analyzed on a quality of answer scale and a quality-of-procedure scale. Quality of procedure, in principle, may limit the quality of answer. However a student may arrive at a general pattern of answer without a proof, or a high order procedure may not lead to the full answer. The two dimensions – quality of answer and of procedure – can be exhibited in a quality-of-solution table. Improvement of mathematical activity is exhibiter in such a table by a "population shift" in the desired direction. The statistical significance of the improvement can be tested, using the Wilcoxon-Raatz test, which is a modified version of the nonparametric Wilcoxon matched-pairs signed-rank test. Assignment tests, within this framework were developed and validated in a series of studies. They were used to compare changes in mathematical activity in a pre-post-control-experimental setting. The results indicate that the assignment projects are indeed effective.

During these studies I became clear that teachers needed more support in a practical form. Therefore, a clinical study was undertaken, in which one class was chosen and all the students interviewed about their work on assignments within the goal-framework. The premise was, that if we could categorize student difficulties and the

guidance into some sort of hierarchy, and establish a link between them, then we would have a model and a language which would help teachers in their work. This led to the establishment of a hierarchy of guidance. Finally, the applicability of the diagnostic guidance was examined successfully in regular classroom setting.