THE NATURE OF MULTIPLE REPRESENTATIONS IN DEVELOPING MATHEMATICAL RELATIONSHIPS

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There is strong support in the mathematics education community that students can grasp the meaning of mathematical concepts by experiencing multiple mathematical representations (e.g.Sierpinska, 1992). The present study investigates how the translations among and within the several modes of representations contribute in the development of students' understanding of various mathematical relationships. It discusses two models that may explain the pattern and difficulties in translating from one form of representation to another. Both models include four factors representing four types of representations in mathematical relationships, namely, the graphical, the verbal, the tabular, and the symbolic (e.g., Janvier, 1996). Each factor involves tasks in which a relationship is given in its specific form (graphical, verbal, tabular, and symbolic, respectively) and students are asked to translate it to the other three forms.

The first model views translations as interrelated. It provides support to the argument that students are able of connecting different representations of a relationship and each representation and translation make clear the meaning of the mathematical relationship. On the other hand, the second model is based on the theoretical assumption that there are modes of mathematical representations that are prerequisites for other representations that are more complicated or sophisticated.

For obtaining the data, a test was administered to 79 Cypriot students in grade 6. Each factor of the study involved three problems that represented relations of the following type: y=ax, y=ax+b, and y=x/a. Analyses using structural equation modeling were performed (Marcoulides, & Schumacker, 2001). It was found that model 2 fits the data in a better way, which means that it explains better than model 1 the structure of the relationships between the factors. Results support that multiple representations and translations constitute different hierarchically ordered entities, and that not all of them contribute to the development of mathematical relationships in the same way.

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