

BAR-ILAN UNIVERSITY

Different Approaches to Teaching Word Problems: The
Impact of the Teaching Method on Student's Knowledge,
with Regard to Gender Differences.

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Abstract

This study deals with different teaching methods in high school, for the topic of motion problems, studied as part of algebra. The issue of word problems in general and motion problems within them is a significant and central issue for all age groups. Solving a word problem consists of two steps: In the first step, the problem is modeled mathematically and in the second step, mathematical tools are applied to the model achieve to a solution. In the process of solving the problems, the student develops the skills of wondering, investigating, searching for a solution, and criticizing it.

In light of the trend toward fostering mathematical literacy and developing mathematical thinking in recent years, the need to expose students to different ways of solving word questions has developed. Since the students' ways of thinking are different from each other, it is important to show different ways of solving word problems in general and motion problems in particular. Previous studies dealing with the subject found that the use of visual representation as part of the learning process improves the students' skills. In addition, searching for different ways of solving problems contributes to raising the student's knowledge level and developing his mathematical thinking. Moreover, studies have found differences between boys and girls in choosing a strategy for a solution. However, the differences between the gender's types of errors, created in the solution process, have not been studied up to this research.

Therefore, the purpose of the present study was to test the effect of the teaching method on the student's knowledge of solving motion problems. That is, to check whether there is an effect of the teaching approach that integrates graphs on achievements, through their ways of solution and their errors. In addition, it was checked whether there are differences between the genders in general and within the groups in particular, with reference to their knowledge.

In this study, the effect of the way of learning motion problems (in a traditional way and in a way of combining it with linear functions) among high school students at the highest level, was examined and compared between boys and girls. The research include 100 students from 10th grade, about half of them boys and about half girls. Fifty students learned to solve motion problems in the traditional approach, using a table 19 of them were boys, and 31 were girls. Fifty students learned how to solve motion problems using a graphic and tabular approach. 27 of them were boys and 23 were girls.

The research tools are: The teaching unit of 8 lessons for each of the teaching approaches, a knowledge test that included 4 motion problems, two of them were questions at a basic level (questions 1-2) and two questions at an advanced level (questions 3-4) and interviews with 16 students - eight students from each group. The study's findings show that the average knowledge test among the participants, who studied in the integrated approach, is significantly higher than the average of the participants who studied in the traditional approach. That is to say, those participants who studied with the integrated approach solved without error with a higher frequency than participants who studied with the traditional approach. With regard to "misunderstanding error", it was found that the average of participants who studied in the traditional approach is significantly higher compared to the average of the participants who studied in the integrated approach.

Among the students that studied with the integrated approach, a difference was found between boys and girls, in choosing the way to solve the knowledge test question. Boys preferred graph solution or a combination solution of the graph with a table while girls preferred table solution.

A significant interaction between the type of errors and the teaching approach was found. The findings indicate that among students who studied according to the traditional approach, the occurrence of an error of the type "making a mistake in understanding of the problem and in the basic construction of the solution" is significantly higher than the occurrence of an error of the type "constructed the mathematical model of the problem correctly but made a mistake in technique or calculation" and the occurrence of an error of the type "solve only partially and stopped". On the other hand, among students who studied according to the integrated approach, no significant difference was found between the occurrences of the different types of errors.

The contribution of this research is, both a theoretical contribution (expanding the existing knowledge base on the subject of teaching word problems) and a practical contribution (providing research knowledge to those engaged in mathematics education in Israel and the world about teaching motion problems in different approaches). So that with the help of this research, it will be possible to structure the teaching of the subject so that it fits for different population groups.

The main limitation of this study is the small size of the sample. It would be worthwhile to carry out a follow-up study on a larger number of students. A larger study sample in

different places in Israel would have made it possible to strengthen the conclusions of this study. This study can raise awareness of the functional approach among teachers since the findings prove its effectiveness. It is worth examining the possibility of developing a training program for teachers as part of continuing education in order to implement the functional approach in schools.