**improving mathematical understanding and performance**

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*In this paper, we propose to show a method we are using to improve mathematical understanding and performance of students who are motivated to study sciences, but who are not defined as gifted children.*

*There are many theories regarding the question of: how to define learning improvement. We define it by two major criteria: The first one is measured by the ability to bring the students beyond the drill-and-practice level and into the solving problems level. By this we mean implementing techniques and concepts as studied to solve more complex problems in some original approach. The second criteria is the level of enthusiasm, inquisitiveness and ambitiousness we can maintain among students in math classes.*

*In order to meet these criteria, we created a curriculum aimed to achieve the goals they dictate. The curriculum consists of techniques and concepts with deep implementations. The students must learn the strength and applicability of each segment of the curriculum.*

**THE METHOD:**

In our curriculum we emphasize the strength and length of implementation of each technique, concept or rule we teach. We use a wide range of problems aimed at implicating the subject studied in many different situations and in a creative way. In this paper we will focus on the subject of **mathematic factoring**. This subject is studied, in Israel, in eighth class of secondary school. The first level of teaching in usual, classic orthodox way. In the drill-and-practice stage, after the regular standard drill-and-practice we include exercise which emphasize and deal with misconceptions attached to the subject.

Example 1:

We know that  .

Without finding the value of x, find the value of 

Intuitively, students will say that the answer is 6. This is, of course, the wrong answer. Students tend to treat the power operation as a linear function. We should demonstrate the right solution which is:



Example 2:

The sides of a given square are x cm long.

We add 2cm to two opposite sides and reduce 2cm from the other opposite sides.

How will the area of the given square change, if at all?

Intuitively the students believe that the area should stay unchanged since what we added to two of the sides we reduced from the remaining two sides. The right answer is, of course: , so the area is indeed changing and is smaller by 4cm².

After this level of drill-and-practice is done, we move to the next level which is solving challenging problems that will demonstrate the strength, applicability and beauty of the proses of factoring in Algebra.

**Calculating using factoring:**

We will start, for example, with the following task:

Without using the calculator, compute the following exercise:



At the beginning, the students can't see the connection to the studied subject. We help them by reasoning the task. If we are supposed to solve this problem without using the calculator, than, we should be able to write the expressions under the square roots as square expression. So, we are aiming to write the expressions in the form of:



We start looking for the components of the brackets:



By simplifying we see that:



This complies with the condition:.

Now we can solve the problem:



**Solving equations using factoring:**

Now we will show students how factoring helps in solving challenging equations.

First task: Find a whole number that solves the equation:

 .

The students, usually, see immediately the resemblances between the expressions in the equation and factoring by the formula: , but it's not trivial to see how to apply it.

The key is to see that in this case:



Now the answer is simple:



Next task: Solve the following equation:



Students believe that an equation is soluble if it has one unknown quantity and it is of maximum the second degree. The truth is that if we can factories the expression in the equation than this "rule" does not apply.

The solution will be:



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