

# ***OPPORTUNITIES AND ALTERNATIVES FOR TRAINING STUDENTS IN USING MATHEMATICAL PROOF IN PRIMARY SCHOOL***

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The study of logical proofs in primary school is not part of the mandatory educational mathematical content in Bulgaria, but it is a virtuoso teaching tool that contributes to the formation and development of students' logical and mathematical thinking.





The purpose of this publication is to present our research on the theoretical foundations of the indirect apagogical proof and the methodological possibilities for the study of the subject in the initial training in mathematics.

## 2.1. THEORETICAL FRAMEWORK

### FIRST STAGE.

Formulation of logical negation  $\bar{T}$  of the statement  $T$ , the precision of which should be proven.

### SECOND STAGE.

Establishing the incorrectness of the formulated negation by the Euclid's Algorithm, i.e. number of consequences are derived from  $\bar{T}$ . The last of these consequences has to be false. From its incorrectness comes the incorrectness of  $\bar{T}$ .

### THIRD STAGE.

From the incorrectness of  $\bar{T}$ , on the basis of the law of the excluded middle, a conclusion is made on the correctness of  $T$ .





**The first stage of the method is connected with the logical operation “negation of proposition” and formulation of contradictory proposition of a certain proposition.**

Formulation of negation of a single proposition

Formulation of contradictory propositions from the logical square

Formulation of negation of compound proposition

Differentiation of contradictory from opposite propositions

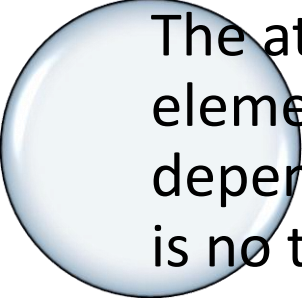


**In the second stage of the negation method is used the rule of negation.**

In this article we illustrate the application of this rule in solving problems from the mathematical curriculum.



**In the third stage of the negation method is applied the law of the excluded middle, according to which one of two contradictory propositions is necessarily true and there is no possibility of a third true proposition.**



The attention of the learners is drawn to the fact that: the elements of a given set are divided into two disjoint sets, depending on whether they have a certain sign or not; there is no third subset.



**The task of the teacher is to prepare his students how to justify their statements starting from the elementary classes with an accessible and appropriate volume.**

**This proof is mostly applied to problems, in which must be proven that there is no element of the set  $P$ , which to satisfy the condition  $L$ , or in which must be proven that every element of the set  $P$  satisfies the condition  $L$ .**

**The present exposition focuses on the design of a theoretical framework of the indirect apagogical proof in specific problems.**





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**In the article we have outlined examples, for which it is suitable to use the indirect apagogical proof.**

**There are also methodological guidelines for some of the examples.**



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## 3. FINDINGS

The structure and the content of this exposition form one option of training of students from the primary education.

This option represents a complete training resource. Its application can be implemented during the optional courses, the mandatory elective training in mathematics, as well as in mathematical schools and workshops.



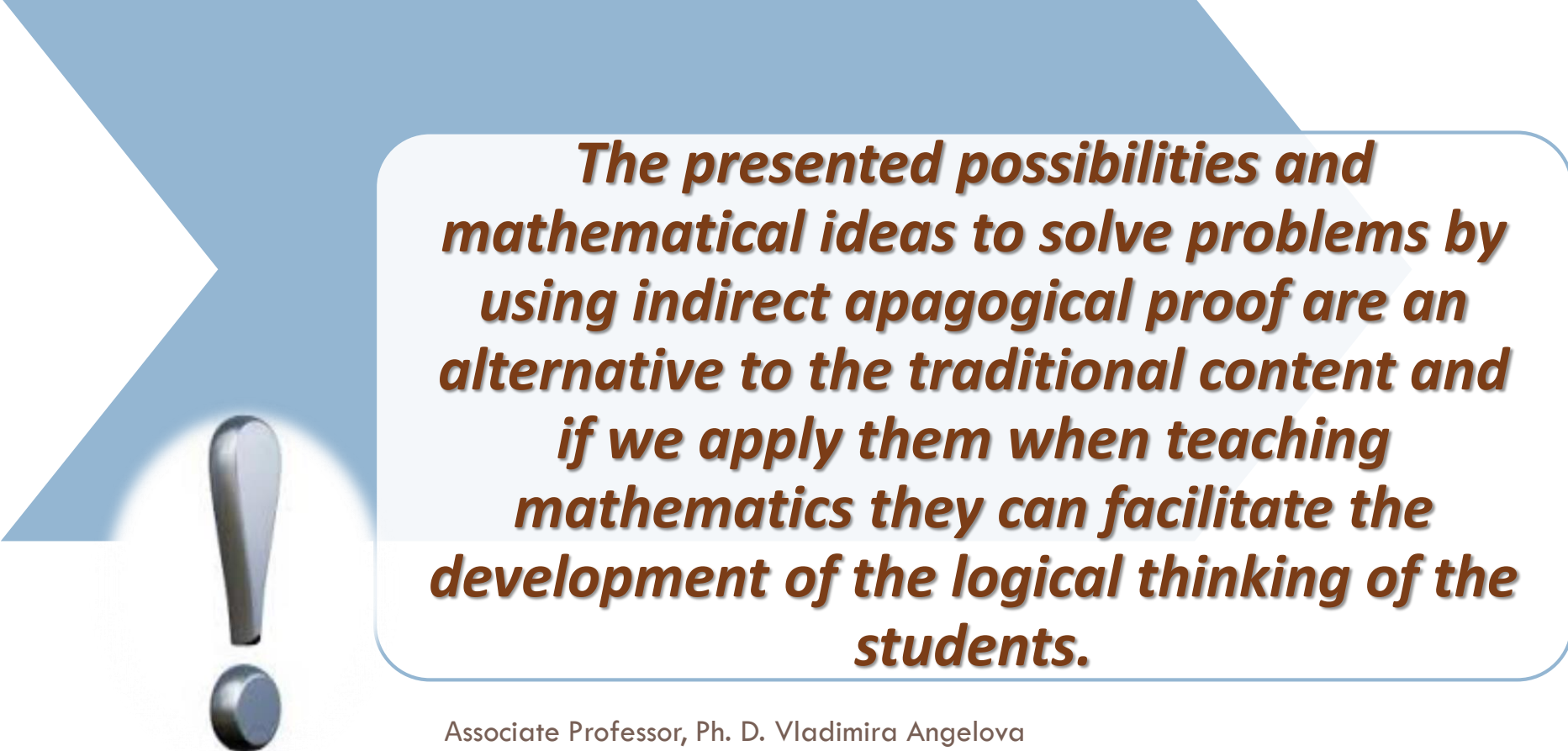


**Upon the design of the present educational resource in the mathematical education, we can present the following as the expected results from the training of the students:**

Assimilation of the structure of the indirect apagogical proof;

Formation of a set of skills and strategies to solve problems by using indirect apagogical proof.

Development of logical thinking.



***The presented possibilities and mathematical ideas to solve problems by using indirect apagogical proof are an alternative to the traditional content and if we apply them when teaching mathematics they can facilitate the development of the logical thinking of the students.***

**THANKS  
FOR YOUR  
ATTENTION!**

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