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Logical Fallacies for Fostering Students' Creativity

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ABSTRACT

Development of thinking and in particular the development of mental qualities – width, depth, independence, logic, mobility, concreteness, criticism, speed, creativity, target orientation and generalization is one of the most important and consistent goals and objectives of mathematical teaching.

Simultaneously, the degree to which this aim is fulfilled determines the level and effectiveness of the teaching process for the overall development of the student's personality. An important psychological and pedagogical condition for the development of quality of thinking is students' reflexive understanding of thinking as a process and their own mental capabilities. Mathematical creativity is not bound by established rules or methods but encourages individuals to challenge and transcend them. It embraces a spirit of playfulness, encouraging experimentation, and the formulation of "what if" questions. It embraces the notion of "productive failure," where mistakes and setbacks are seen as opportunities for learning and generating new ideas.

This work attempts to promote creativity using logical fallacies. Logical fallacies can be used during everyday mathematics classes, especially during classes for exercises through a few examples. Well-chosen examples can improve and empower the process of doing mathematics and can stimulate the process of creative thinking and motivate students' individual development in their current learning and understanding and lead to the formation of intellectual reflection.

Keywords: logical fallacies, creativity, student's thinking, learning and understanding

MATHEMATICAL STATEMENTS, LOGICAL LAWS, CONCLUDING

A sentence that makes a statement about mathematical objects is called a mathematical sentence or a mathematical statement.

Example: If a quadrilateral is a rectangle, then it has two axes of symmetry.

A mathematical statement that is true, and its truth is established by proof, is called a theorem. Each theorem contains a condition and a conclusion, that is, it can be expressed with a conditional sentence (conditional form) given in the form "If…, then…", i.e. the form of implication.

The conditional formulation of a theorem has the following an advantage in which the condition – what is given in the theorem and the conclusion – what needs to be proved are clearly delineated. Also, a theorem can be expressed with a "categorical" sentence, in such a case we say that the theorem is formulated in a categorical form. If it is a theorem, then the implication is called a converse statement with respect to the theorem In that sense, the theorem is called a direct statement. If the converse statement of a theorem is true, then it is called the converse theorem of the given theorem.

Mathematical statements that are accepted as true without proof are called axioms. Axioms are also called: initial or basic statements.

Errors in the adoption of mathematical statements

It is natural to expect students to make mistakes when learning theorems, but the teacher should discover the source of those mistakes and try to eliminate them. The most common types of errors are:

a) Insufficient knowledge of the basic theorems of the relevant field (planimetry, equations, functions, etc.);

b) Errors of a logical nature, related to the misunderstanding of the deductive structure of the mathematics course (for example: incorrect meaning of terms, misunderstanding of the structure of the reasoning and the generality of the proof);

c) Improper use of the drawing.

Example 1: “The bisectors of the angles of an isosceles triangle, with their point of intersection, are divided in the ratio 1:2.” (?!) (“Justification”: isn’t the bisector of the angle at the top also a line of gravity?). Here we have an error of type a).

Example 2: If, after proving the claim that the area of an equilateral triangle with a side is equal to, the problem is set: “The area of a triangle with a side is equal to.” To determine the type of triangle.” many of the students will answer that the triangle is equilateral. It is easy to see that in this case they think according to the scheme. To convince them that this kind of thinking is not correct, it is enough to say that there is a tracer with area and side, which is not equilateral. (see Figure 1).

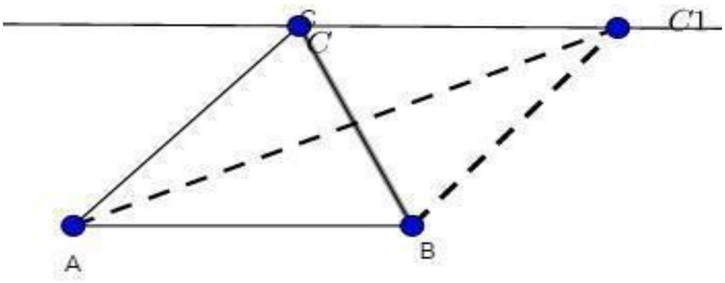

Figure 1

Reasoning and drawing a conclusion

Reasoning is one of the main forms of opinion. It is a thought process, aimed at confirming or refuting a claim or at obtaining a new conclusion from one or several claims.

Deriving a conclusion is a mental operation by which, from one or more statements that are in a mutual meaningful relationship, as a result of reasoning, a new statement is obtained that contains new knowledge in relation to the original statements.

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Assertions from which a new statement is built using reasoning are called premises, and a new statement obtained by comparing or combining the assumptions is called a conclusion.

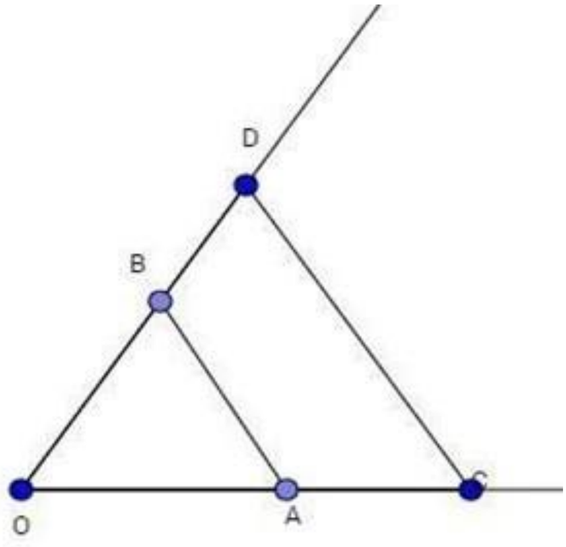
The conclusion of a reasoning will be correct (or true) if the following two conditions are met:

1. The assumptions are true,

2. The laws of opinion are correctly applied when operating logically with assumptions, i.e. when comparing and connecting them (correct reasoning). If a conclusion is drawn on the basis of two or more assumptions, then the inference is called indirect. If the conclusion is based on only one assumption, then the conclusion is called direct. If incorrect reasoning is done intentionally, in order to "prove" a truly false claim, then such reasoning is called sophistry. Sophism is based on the ambiguity of some concepts, as well as on proving incomplete assumptions. Incorrect reasoning is sometimes used intentionally in teaching in order to check the correctness and level of knowledge acquisition. Such reasoning is called teaching sophisms.

Tasks:

1. Prove or make sophism that every two segments are equal.



2. Proof or make make sophism that 2+2=3 (if we cut one piece of paper on two part and take one part and make the same we can say 2+2=3, because if we count the pieces we will have three pieces)

3. Proof or make sophism that 0=1

4. Make and proof five different sophisms and explain where the mistake is. Can you make generalization?

CONCLUSION

This paper argues that logical fallacies can be leveraged as a powerful tool for fostering creativity during mathematical classes. By introducing logical fallacies within the framework of mathematical concepts, educators can encourage students to think critically, question assumptions, and explore alternative problem-solving approaches. While embracing logical fallacies may present challenges, the potential benefits for student engagement and creativity outweigh these concerns. As teachers aim to create dynamic and engaging mathematical learning environments, incorporating logical fallacies can be a valuable addition to their pedagogical toolkit improving students' understanding and getting long-lasting structural knowledge for the best students.

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