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TRADITIONAL AND MODERN TEACHING METHODS IN MATHEMATICS

Roxana ARDELEANU [a]*

[a] "Vasile Alecsandri" University of Bacău, Mărășești 157, 600115, Romania

Abstract

It is well known the difficulty of teaching and learning Mathematics in schools. But, over the last years, teacher's teaching style has changed significantly. The traditional way that Mathematics was delivered (through memorization and repeating techniques) is replaced by the modern way (applied way) of teaching and learning Mathematics. The aim of this paper is to describe the positive impact and the importance of modern teaching methods. This paper recommends that all Maths teachers should use modern, interactive methods in order to improve the performance of their students.

Key words*:* Didactic methods; Mathematics; teaching

1. Introduction

Most Mathematics teachers use traditional methods when it comes to teaching Mathematics (e.g. white/ black and marker/ chalk). Thus, the teacher plays the role of an instructor. He is the one who decides which teaching-learning method will be used. Most often students are regarded as having "gaps in knowledge" that the teacher must fill with lots of information. Too often, Mathematical education is separate from the students' daily experiences. Thus, the teacher fails to engage the students' interests in the transfer of new knowledge. So, the teacher has to answer questions such as "Why do we need it?", "Why do we need to learn this?".

It is obvious, and research confirms this, that students learn much better when they are encouraged to discover their own knowledge of the surrounding world (Satchwell, 2002). It's about the so-called experiential learning. In order to improve students' Mathematics and their literacy ability, Mathematics teachers (but also those of other sciences) should have the freedom

* Corresponding author. Lecturer PhD
E-mail address: rardeleanu@ub.ro

and ability to develop and apply modern strategies that give pupils the opportunity to discover new knowledge and to develop problem-solving skills from the process of defining and optimizing a solution to a genuine, real-world practice. It is obvious that besides the modern methods that should be used more often than the traditional ones, the use of integrated learning is also useful. The latter will provide opportunities for more relevant and stimulating experiences for students, regardless of their age (Frykholm, 2005). Thus, the recommendation of the European Parliament and of the Council of 18 December 2006 (2006/962 / EC) is to include Mathematical competences and basic competences in science and technology within the key competences for lifelong learning.

A criterion for classifying the teaching methods can be related to their history in the educational process (Moise, 1999): traditional methods, such as didactic exposition, didactic conversation, demonstration, observation, working with the manual, exercise and modern methods, such as algorithmization, modeling, problematization, programmed instruction, case study, simulation methods, discovery learning.

2. Traditional methods

Traditional educational methods are still widely used in schools. The traditional approach to Mathematical learning occurs when students are guided through a curriculum established Mathematical concepts by an expert educator/ teacher. What do we see when we enter a classroom where traditional methods are used? We see students usually seated, allowing everyone to have a clear view of the teacher in front of the class. We notice that the teacher has the lead role. He/ she teaches a new concept, ensuring that it relates the new concept to the concepts previously learned by the students. The teacher usually uses a black or white board to work on a short set of examples and to explain the concept. The teacher will most likely want to ask ideas from students as problems are solved, involve them in the Mathematical concept and maybe stimulate student thinking.

Once the teacher introduces the new concept, students have the opportunity to put their new knowledge into practice. This usually involves problem solving and Mathematical exercises in their manual or on worksheets. Students work individually on solving problems, while the teacher walks around the class and provides additional explanations where necessary. Students can also ask for help directly from the teacher (by raising their hands) when they have a problem they cannot solve independently. At the end of the lesson, the teacher works with the whole class again and focuses on addressing more difficult questions or problems, reinforcing the new concept /

notion taught and highlighting the correct method to solve them. The teacher eventually assigns homework for students so that they can continue to practice and consolidate their newly taught notions. Among traditional methods of teaching-learning-evaluation in Mathematics are exposition and exercise.

2.1. The exposition method

Exposition as a method of teaching-learning-evaluation is also called the expository or affirmative method. It is a traditional method of oral communication that consists in transmitting a sufficiently large volume of knowledge (Cojocariu, 2004). Within the framework of this method, the didactics is based on verbal statement and words as an educational tool. The method is quite controversial because it does not focus on the student, who is just a member of the audience for the communicated knowledge, and the teacher-student relationship is unilateral, the interaction in the class being minimal. At the same time, the method is effectively used to communicate directly with the child (Cerghit, 1997), but it can cause superficiality and formalism in understanding ideas and logically expressing them. Among the three forms of exposition (story, explanation, and lecture) most often used in Math classes is the explanation. Lecture is a superior form of exposition that is successfully applied in Math courses in university.

Explanation involves rigorous reasoning and rational use of the knowledge (notions, concepts, etc.) by the teacher, with the purpose to help students understand rules and information, as well as express the newly acquired information in their own words. A very important role in transmitting and learning mathematics is the explanation based on a deductive argumentation of the notions, the fundamental properties of the various operations, for example, or the step-by-step disclosure of the algorithms for solving equations (Jinga, 2019). The teacher should carefully choose the examples to capture the essentials of the notions taught in the lessons and so facilitate their understanding. Usually, in Math classes, explanation is accompanied by exercise.

2.2. The exercise method

The exercise is a practical (operational) method of conscious repetition of an activity that aims at skills training, knowledge building and development of intellectual capacity [Cojocariu 2004]. The exercise method used for Maths classes involves knowing the goals/ objectives of the lesson, exemplifying and demonstrating the model by the teacher, grading the exercises, repeating them in stages, and integrating into the system of knowledge and problems. Mathematical exercises contribute to students' independent work skills, understanding of concepts, computation rules, strengthening of knowledge. But their lack of monitoring can lead to acquisition of wrong skills

and notions. In addition, there must be increased attention to the degree of difficulty and the diversity of exercises, because lack of diversification can lead to boredom.

Application for Mathematics – 5^{th} grade, Lesson topic: Divisibility rules: divisibility by 2, 5 and 10^n

The teacher announces and writes the title of the lesson on the blackboard and specifies the lesson's objectives (consolidating the previously acquired knowledge, the correct notation of the divisibility relationship, identifying numbers divisible by 2, 5 or 10^n from a string of natural numbers, using the divisibility rules for the numbers written in base 10 that have letters instead of numbers). To assimilate the divisibility rules, students work on the blackboard and on their notebooks exercises such as:

- write the first 6 multiples of 2;
- from the given series of numbers circle those that divide exactly by 2.

After solving the exercises, the students will answer the question "What is the last digit of the chosen numbers?" and they will be explained that any number ending with an even number is exactly divided by 2. The divisibility criterion of 2 is formulated and students write it down on the notebooks. Similarly, using the exercises, explanation and exposition, the rules for divisibility by 5, 10 and 10^n respectively are set out. Students work at the blackboard exercises with varying degrees of difficulty.

3. Modern methods

What do we notice when we enter into a class where modern methods are used? Instead of the rows of desks seen in the traditional classroom, we will see desks grouped together so that students can interact with each other as they learn. Therefore, the emphasis is on students. This differs greatly from traditional teaching methods, where students are seated in order to ensure that the focus is on the teacher. Students are divided into small work groups up to five to six students each. These small groups can be formed based on student Math skills and therefore the parties do not change frequently. In this way, students are used to work together and they are convinced that, if necessary, their colleagues can provide support for them to successfully complete their work. Modern learning methods involve students in activities by using concrete materials, simulations and games to explore new Mathematics. An alternative to the traditional methods of teaching-learning-evaluation in Mathematics presented above is given by modern methods such as the jigsaw and cubing.

3.1. The Jigsaw method

The jigsaw method, created by the American social psychologist Elliot Aronson, is also called the interdependent group method and is a method based on the concept of team learning (Satchwell, 2002). The method involves dividing the classroom in working groups. One member of each group receives a study task in which he has to become an expert, and then he/she should initiate their colleagues into that subject. For the successful application of the method, the following steps must be taken: establishing the theme and dividing it into 4-5 subheadings, organizing learning groups, setting up expert groups, returning to the initial learning team, and evaluating.

Essential to this method of teaching-learning is interdependence among group members. Thus, the members of a team are stimulated to collaborate, because the common task cannot be fulfilled unless each student contributes. Moreover, the tendency to establish a group hierarchy and social laziness that often threatens cooperation in a group are eliminated. The interdependence between members and individualisation of the contribution are complementary to this method. The use of this method aims at developing the capacity for reflection, active listening, cooperation, creative thinking and increasing the cohesion of the groups; students must understand that solving the problem is both the benefit of the group and of each individual.

3.2. The Cubing method

The Cubing Method, first proposed by Gregory and Elizabeth Cowan (1980), is a teaching-learning strategy that involves exploring a subject from six perspectives by applying an algorithm to describe, compare, associate, analyse, apply and argue. In this respect, the teacher creates a cube having on each facet one of the above activities/tasks. After announcing the topic to be discussed and dividing the class into six workgroups, the teacher will distribute (randomly or otherwise) the task corresponding to each cube side. A working time will be established in which students, together or individually, solve the task, and after that they present and evaluate the final form of the results of each group. The cubing method also stimulates collaboration, creativity, teamwork, awareness of one's own attitudes, creative thinking, analytical and synthesis ability and develops communication skills.

Application for Mathematics – 5^{th} grade

Lesson topic: Divisibility Criteria with 2, *5 and* 10^n.

Using **the Jigsaw method**, the teacher, who has the prepared worksheets, proposes the topic of study, announces the objectives and divides the class into 4-5 groups of 4-5 students. Each student receives a worksheet containing a subtitle, denoted with a letter (A, B, C, D). All sheets include parts of a lesson to be understood by students. The proposed subtopics can be: Worksheet A. The divisibility criterion by 2; Worksheet B. The divisibility criterion by 3, and so on.

After receiving the papers, all pupils with the same letter on the sheet, group together to form expert groups. In each group of experts, students must read the material on the paper, discuss, analyse, give examples, and decide on how they will present their subject to the classmates.
In the next step, each expert returns to the group and presents the section prepared for colleagues.
In the next step, each expert returns to the group and presents the section prepared for colleagues.
Thus, finally, in each initial group, students are supported to discover and acquire the criteria of divisibility, with examples. Each student becomes a teacher, aware of their own learning, their role in the initial group is the correct and complete transmission of information. Thus, the teacher only monitors students' activities in order that the information to be correctly understood and retransmitted and intervenes only if necessary.

At the end of the class, through oral presentation, the contents taught are reviewed and some exercises well chosen by the teacher will be developed to highlight the level of understanding of the subject. The teacher can ask questions, ask for a report or essay, or give an individual assessment sheet to each student. If oral evaluation is used, then each student is asked a question to answer without the help of the team.

We use the cubing method for a lesson of recapitulation and systematization of knowledge for the unit of learning Divisibility of Natural Numbers, 5^{th} grade. The teacher has prepared a cardboard cube with sides of different colours, according to the lesson topic and divides the class into six groups of students. By throwing the dice, each group will analyse the proposed topic according to the verb associated with that face.

Side 1 - blue - DESCRIBE - Describe notions of divisor, multiple, exact division, prime number, etc.

Side 2 - green - COMPARE - Find similarities and differences between the divisibility criteria by 2 and by 10, then by 5 and by 10, by 10 and by 10^n. Group them into a composition.

Side 3 - orange - ASSOCIATE - Underline the numbers divisible by 2, circle the numbers divisible by 5, etc. Assign the digits corresponding to the letters so that the given relations of divisibility become true: $2 \mid \overline{35a}$, $3 \mid \overline{2b1}$, etc.

Side 4 - red - ANALYZE - Determine how many rectangles can be made with sticks of different lengths, namely: 4 sticks of 1 cm, 5 sticks of 2 cm, 7 sticks of 3 cm and 8 sticks of 4 cm. Analyse whether a rectangle can be formed by putting all of the sticks together.

Side 5 - yellow - ARGUE - Specify the truth value of the following sentences: $2 \mid 2548{,}3 \mid 426{,}2 \mid 357{,}1545 \vdots 3$, etc., "The sum of two even / odd numbers is an even / odd number." Find a common multiple of numbers 6 and 4. Show that any common multiple of numbers is divisible by their product.

Side 6 - purple - APPLY - Determine two natural numbers knowing that their sum is 20 and their largest common divisor is 15. Find the smallest natural number that divides in turn at 12, 18, and 30, and there results the rest 8.

So, students can exchange worksheets or they can put on the boards the exercises that seemed more difficult for them. The method also stimulates collaboration and teamwork. Teacher monitors the activity, gives instructions and makes sure that all students are actively involved in solving the task.

4. Conclusions

Teaching methods have changed a lot over the last few years. It is obvious that learning by heart, memorizing and exposing or reciting should be abandoned. Sonia Jackson (2012) wrote a blog post on modern teaching methods for Smart Getting. She says: "The traditional chalk and speech teaching method, which has lasted for hundreds of years, now achieves inferior results compared to the modern and revolutionary teaching methods available for use in today's schools. It encourages more intense student interaction; authority limits are broken down and emphasis is placed on students' joy to learn." The mathematics teacher will use both traditional methods and modern teaching methods to meet the requirements of the school syllabus and to facilitate the development of logical reasoning. The success of a mathematics lesson depends on how the teacher manages to choose the most suitable methods, and didactic instruments, to combine them and to organize them in a harmonious assembly to achieve the proposed objectives.

References

Aronson, E., & Patnoe, S. (1997). *The jigsaw classroom: building cooperation in the classroom*. 2nd ed. New York: Longman.

Boghian, I. (2018). *Methodological Guide for language students and language teachers: English, French, Romanian*. Cluj-Napoca: House of Science Book.

Cerghit, I. (1997). *Metode de învățământ* [Methods of education]. București: Didactic and Pedagogical Publishing House.

Cojocariu, V. M. (2004). *Teoria și metodologia instruirii* [The theory and methodology of instruction]. București: Didactic and Pedagogical Publishing House.

Cowan, G., & Cowan, E. (1980). *Writing*. Wiley.

Frykholm, J., & Glasson, G. (2005). Connecting science and Mathematics instruction: Pedagogical context knowledge for teachers. *School Science and Mathematics*, 105(3), 127-141.

Jackson, S. (2012). 3 New Teaching Methods Improve the Educational Process. Retrieved from https://www.gettingsmart.com/2012/09/3-new-teaching-methods-improve-educational-process/.

Jinga, E. (2019). *Matematica învățată cu metode consacrate* [Mathematics learned by consecrated methods]. EDICT, Terieved from https://edict.ro/matematica-invatata-cu-metode-consacrate/.

Moise, C. (1999). *Concepte didactice fundamentale* [Fundamental didactic concepts]. Iași: Ankarom Publisher.

Satchwell, R. E., & Loepp, F. L. (2002). Designing and Implementing an Integrated Mathematics, Science, and Technology Curriculum for the Middle School. *Journal of Industrial Teacher Education*, 39(3). Retrieved from https://scholar.lib.vt.edu/ejournals/JITE/v39n3/satchwell.html.