Dofinansowane przez Unię Europejską

Erasmus+ project "Developing selected competences of key students in lessons and in school extracurricular activities"
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SCENARIO OF A DEMONSTRATION LESSON CARRIED OUT AS PART OF THE ERASMUS+ PROJECT
SCENARIO OF CLASSES FOR CLASS VIII - mathematics
HOST: Aneta Ślifirska

TOPIC – Logical reasoning and the "tax office".

Lesson objectives:

General objectives (in accordance with the core curriculum):

- Developing logical reasoning and argumentation skills.
- Developing accounting and algebraic skills.
- Developing the ability to solve mathematical problems.
- Using mathematics in practical situations.

Specific objectives:

- The student plans a strategy for choosing numbers based on their mathematical properties.
- The student recognizes and determines the divisors of a natural number.
- The student interprets the result in the context of the task.
- The student cooperates in a group and communicates his/her thinking.

Key competencies:

1. Mathematical competence
   - Number divisor recognition.
   - Arithmetic and logical calculations.
   - Solving mathematical problems in the context of a strategy game.
   - Analytical thinking and predicting the effects of actions.

- Breaking the problem apart.
- Formulating hypotheses and testing them.

2. Personal, social and learning competences
   - Group collaboration.
   - Making decisions and reflecting on their effects.
   - Learning by doing and experiencing.
   - Perseverance in pursuing a goal.
   - Awareness of one's own strategies and mistakes.
   - The ability to judge what works and what doesn't.

3. Entrepreneurship competences
   - Planning an action strategy.
   - Risk assessment (e.g., which numbers "cost" the most divisors).
   - Creativity in the approach to the task.
   - Striving to maximize the result.

4. Civic competences
   - Understanding the concept of tax as a social mechanism.
   - Reflection on the role of public institutions (e.g. the tax office).
   - Discussion on the fairness of the tax system.

TEACHING CONTENT - SPECIFIC REQUIREMENTS (CORE CURRICULUM):

- The student knows the concept of the divisor of a number.
- The student performs mathematical reasoning.
- The student justifies the correctness of the solution and evaluates the reasonableness of the solution.
- The student notices the relationships between numbers and their divisors.
- The student creates an action strategy based on mathematical analysis.
- The student cooperates in a group to solve a mathematical problem.
- The student communicates his reasoning and conclusions.

OBJECTIVES FORMULATED IN THE STUDENT'S LANGUAGE:

In today's lesson:

- I will learn to recognize the divisors of a number – that is, to check by which numbers it can be divided without remainder.
- I will understand how choosing one number affects others – and how to use it to get the most out of it.
- I will plan the strategy – that is, make decisions that pay off.

Methods and forms of work

Methods:

- Problem method.
- Myśląca klasa (ThinkingClassroom).
- Mathematical discussion.
- Student reflection.

Forms of work:

- Work in randomly selected groups of 3 people.
- Work on dry-erase boards or sheets of paper.
- Presentation of solutions by students.
- Individual written reflection.

TEACHING RESOURCES

- Dry-erase boards or large foils hung in the classroom.
- Mazak for each group.
- Random division of students into groups of 3.
- Drawing cards to be divided into groups.

Tips for working with people with diverse developmental needs:

- Use multiple visuals and gestures.
- Adjust the pace of work to the abilities of the students.
- Provide additional support.

ESTIMATED TIME: 45 minutes

ORGANIZATIONAL PHASE

1. Cleaning and organizational activities: greeting, checking the attendance list.
2. Giving the topic of the lesson.
3. Providing the objectives of the lesson in the student's language.

IMPLEMENTATION PHASE:

1. The teacher presents the content of the task orally to the students standing around him, according to the following scenario (divides the students into groups) (10 min):

N - "We have 12 envelopes with money here. [*The teacher draws 12 rectangles on the board and writes 1, 2, 3 zlotys in each of them, etc.*] This is your money. I keep them for you. You can take any envelope whenever you want. Just ask. Which one do you want first?

U - *Students choose one (probably 12 PLN)*

N - Ok. Please. [*The teacher pretends to give an envelope and they circle the one with a face value of 12 zlotys*] This envelope is no longer there. Come on..... I forgot to tell you that you have to pay tax on this money. You took 12 zlotys, so the Tax Office takes envelopes with the amounts of 1, 2, 3, 4, 6 zlotys [*The teacher crosses out the envelopes when he lists the amounts*]. Why did the office take these envelopes?

U - these are the divisors of 12.

N - The tax collector took them, so which one will you choose from the others?

[*Students will probably choose 11.]*

N - However, I forgot to add that the office always has to take some tax. Therefore, if you choose an envelope for yourself, there must always be at least one envelope to be taken by the office - i.e. at least one divisor of your amount. Can you take 11 PLN then?

U- No.

N - Then which one do you choose?

U - Students will probably choose 10. [*The office will take 5 zlotys. The numbers 7, 8, 9, and 11 remaining, which students can no longer take*]

N - The office is very honest and does not want anything to be wasted and takes the rest of the envelopes. [*The teacher crosses out the remaining envelopes*]

N - You have 22 PLN. This is not a good result. In your opinion, it is to get more.

The teacher draws the composition of the groups (e.g. by cards, dice).
Students line up at designated boards and receive dry-erase markers.

2. Work on the task (15 minutes)

- Students analyze the problem together in groups and write down their thinking.
- The teacher walks around the classroom and unanswered thought-provoking questions. However, it can ask guiding questions:
    - Why do you think so?
    - Was it a statement or a question?
    - Are you sure?
    - Interesting, isn't it?
    - Can you show me how you came to this?
    - Does it make sense to you?
- A teacher can motivate students by saying, for example, I saw more.
- It only answers questions that sustain thinking.

5. Presentation of solutions (10 minutes)

- Selected groups present their solutions.
- The teacher moderates the discussion by comparing different strategies (algebraic, graphic, trial and error).
- Students comment and ask questions to other groups.

4. ✍ Reflection and summary (10 minutes)

- The students answer the following questions:
    - What numbers have the most divisors?
    - What was the most difficult?
    - What strategies were effective?
    - Was it worth starting with the largest amount?
    - Was it possible to predict which envelopes would disappear?
- The teacher sums up the lesson, emphasizes the value of cooperation and thinking.

Notes to the teacher

- Pay attention to communication in groups – encourage active listening.

- After class, you can collect photos of the boards as documentation of the thinking process.

BIBLIOGRAPHY:

- Building thinking classes in math lessons. Peter Liljedhal

WORK EVALUATION

1. Can I recognize the divisors of numbers? :
   .....
2. What would I do differently if I played again?:
   .....
3. What did I learn today?:
   .....
4. Did we make decisions together in a group?
   .....

Side task (if the group is working efficiently)

"A certain man made a certain amount of money. The tax office took half of what he earned, plus 100 zlotys. After this operation, he was left with 100 zlotys. How much did he earn?"

MATERIAL FOR THE STUDENT

Problem task

A certain man earned a certain amount of money. The tax office took half of what he earned, plus 100 zlotys. After this operation, he was left with 100 zlotys. How much did he earn?

✍ Individual reflection (for the notebook):

1. What was the most difficult thing for me in this task?
   ……..
2. What strategy did I use?
   ……..

Mark how you felt while working on the task:

☐ I felt confident

☐ I needed help

☐ I'd like to try again

TEACHER'S OPINION METHODOLOGIST

The lesson plan based on the "Thinking Class" method deserves a high rating due to its innovativeness, effectiveness in activating students and compliance with current trends in teaching. This method, developed by prof. Peter Liljedahl, has been tested and implemented in many schools, including Poland.

Key benefits of the scenario:

- **Problem Tasks**: The lesson begins with an engaging task that requires you to think and not just recreate diagrams. This stimulates students' curiosity and motivation.
- **Random groups and vertical surfaces**: This arrangement fosters collaboration, reduces the stress of mistakes, and increases engagement.
- **Verbal commands and no "classroom front"**: This increases students' mindfulness and supports their independence.
- **Questions that sustain thinking**: The scenario envisages interactions that do not interrupt the cognitive process, but deepen it. The teacher only answers questions that support reflection and analysis.

Methodological conclusions:

The lesson scenario in "The Thinking Classroom" is in accordance with the principles of formative assessment and constructivist pedagogy. It supports the development of key competences such as critical thinking, cooperation and self-reliance.

Alina Kaczmarczyk

APPROVAL BY THE SCHOOL PRINCIPAL

The script has received a positive opinion in terms of content and methodology – I approve it for implementation.