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“INNOMATH - Innovative enriching education processes for Mathematically Gifted Students in Europe”

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Title of Content: **M10- Cooperative Learning for teachers and students**

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M10- Cooperative Learning for teachers and students

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1. **Establishing group rules**
2. **ICE BREAKER**
3. I KNOW// I want to know/ I learned
4. **ROLE PLAY**
5. **FOCUS ON CONTENT**
6. **WINDUP / REMARKS /FEEDBACK**

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1.Establishing group rules

Text

The participants propose group rules at the beginning of the joint training session

1. **We talk in turn**
2. **We address the second person singular**
3. **We respect our opinion**
4. **Good comunication**
5. **Tolerance**
6. **Empathy**
7. **We use technology in the training session**
8. **We promote a digital learning environment**
9. **Active and interactive collaboration and participation**

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Activity 1: BASIC ELEMENTS OF COLLABORATIVE LEARNING

At the beginning of the working session, the trainers establish the specific rules of communication with the participants

- Each participant receives a post that will convey their name, organization of origin, country and a word to define collaborative learning between students and teachers.

Participants justify their choice.

- Theoretical session: trainers will present the approach to cooperative learning (the presentation starts with a film about the origin of cooperative learning).

- Discussion and reflection: the trainers will stimulate the discussions between the participants through reflection questions.

- Brainstorming participants complete the first two columns of the I know / want to know about collaborative learning method, and the last column will be completed at the end of the work session after participants provide feedback on what they have learned

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Activity 2 THE ROLE OF STUDENTS in collaborative learning

Co-operative Learning - Origin and Concept

https://www.youtube.com/watch?v=7zKNpqGlhd0

Within each group, the roles played by the students can be oriented towards solving the task, maintaining the group or both. Because students need to learn behaviors necessary to perform both roles, sometimes the teacher explicitly distributes the roles in the group, for example:

CONTROLLER: Make sure the group members understand what

it works.

RESEARCHER: Look for the necessary information in other groups or,

sometimes even to the teacher.

CHRONOMETER: Make sure the group focuses on the task

and comply with the time limits fi xate.

hearer

ACTIVE: Repeat or rephrase what the other members of the group have said.

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Activity 3 **Motivation techniques and strategies for students actively involved in the learning process in learning mathematics**

Collaborative Learning Vs Co-operative Learning (English)

https://www.youtube.com/watch?v=QgxfAh1S38g

Motivational teachers to develop students' understanding of fundamental concepts - not memorizing facts, definitions and procedures - as a first priority. Many of the classroom strategies used by these teachers have proven to be both cognitive science and learning research the best methods to help students build and use knowledge in math and science.

This report describes five of these strategies, called contextual teaching strategies:

• **Relationships** - learning in the context of life experiences or pre-existing knowledge

• **Experimentation** - learning by doing or through exploration, discovery and invention

• **Application** - learning by using concepts

• **Cooperation -** learning in the context of sharing, responding and communicating with other learners

• **Transfer** - the use of knowledge in a new context or in a new situation - one that has not been covered in class

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Activity 4 Examples of good practice - Techniques and motivational strategies for students actively involved in the process of learning mathematics

RELATING

Relating is the most powerful contextual teaching strategy. It is also at the heart of constructivism. Relating is learning in the context of one's life experiences or preexisting knowledge.

Excellent teachers plan carefully for learning situations in which students can experience felt meaning. Careful planning is needed because often students do not automatically connect new information to the familiar. Research shows that, although students may bring memories or prior knowledge that is relevant to a new learning situation, they can fail to recognize its relevance.8

When teachers both provide environments in which students activate memories or prior knowledge and recognize the relevance of the memories or knowledge, they are using relating.

As an example, consider a mathematics lesson on ratio and proportion. A traditional approach typically begins with a definition, followed by an example:

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EXPERIENCING

EXPERIENCING

Relating connects new information to life experiences or prior knowledge that students bring with them to the classroom. But this approach is not possible if students do not have relevant experience or prior knowledge. Teachers can overcome this obstacle and help students construct new knowledge with orchestrated, hands-on experiences that take place inside the classroom. This strategy is called experiencing. It is learning by doing— through exploration, discovery, and invention. In-class hands-on experiences can include the use of manipulatives, problem-solving activities, and laboratories. Manipulatives. These are simple objects that students can move around to model abstract concepts concretely. For example, in mathematics, base-ten blocks model numeric representation in the decimal system. Fraction bars demonstrate the meaning of simple fractions and addition and multiplication of fractions. Area tiles model multiplication of Page 6 polynomials. Some computer programs, such as Geometer's Sketchpad and Cabri, can be considered manipulatives since they enable students to visualize and explore concepts and to quickly see answers to "what if ? " questions. Manipulatives have been shown to enhance student performance when they are coherently integrated into the curriculum.

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Problem-solving activities.

These are learning experiences that engage students' creativity while they are learning key concepts. These activities also teach problemsolving skills, analytical thinking, communication, and group interaction. The best problem-solving activities introduce key concepts—usually curriculum objectives or standards—as they arise naturally in problem situations. This allows students to see a need or a reason for using the new concepts. When they see relevant uses of knowledge in solving interesting problems, students can make sense of what they are learning.18 This has been shown to motivate students to exert the required effort to gain and use the new knowledge.19 An example of this kind of problem-solving activity is a continuation of the lesson on ratio and proportion. After introducing the concept of ratio using relating and the instructions for making fruit punch, the teacher poses a problem: "How many cans of concentrate and how many cans of water are needed to make fruit punch for the whole class?" Students working individually or in groups are likely to try several different problem-solving approaches and have different solutions, because answers depend on students' assumptions. (How much punch is needed? How can we make sure we use the same 3 : 1 ratio of water to concentrate?) Relevance and motivation can be enhanced if students know that at the end of the lesson they will, as a class, decide on a single best solution and then actually make the fruit punch to "check their answer." This activity can create motivation for the need to know about and use ratio and proportion, but students are very unlikely to discover the key mathematical concepts on their own. The teacher must be prepared to facilitate student discussion and problem solving, summarize students' approaches and results, and demonstrate and generalize the concept at the right time. In mathematics, definitions and solution procedures are part of this generalization. Generalizing the specific experience or information is a key step in learning. Research shows that students have a greater ability to use new knowledge in multiple contexts, beyond those covered in class, when the teacher (or, if possible, the Page 7 student) generalizes key information after the student uses the information or experience in a specific context.20 The ability to use new knowledge in novel situations is called transferring, and we will discuss it more later as a separate contextual teaching and learning strategy.

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APPLYING

We define the applying strategy as learning by putting the concepts to use. Obviously, students apply concepts when they are engaged in hands-on problem-solving activities and projects like those described above. Teachers also can motivate a need for understanding the concepts by assigning realistic and relevant exercises. These exercises are “word problems” like those found in all textbooks. But they have two major differences: They pose very realistic situations, and they demonstrate the utility of academic concepts in some area of a person’s life. Both are important for application problems to be motivational. For example, the following is a typical word problem a geometry lesson on volume of solids. It may be “real world,” but, after assigning this problem, how would you answer a student asking, “So what?” A hemispherical plastic dome covers an indoor swimming pool. If the diameter of the dome measures 150 feet, find the volume enclosed by the dome in cubic yards. The intent of the problem is to have students recall and use the formula for the equation of the volume of a sphere. The problem statement below also requires students to recall and use this formula. But in this problem, the formula and calculation are crucial in a believable decision-making situation. This problem inherently answers, “So what?” Montgomery is a pharmacist at a pharmaceutical manufacturing plant. He is responsible for selecting the correct capsule sizes for the company’s products. The capsule size determines the dosage. The company uses eight sizes. The body length lB, cap length lC, and diameter d of the capsules are shown in the table.

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COOPERATING

many problem-solving exercises, especially when they involve realistic sitionuats, are complex. Students working individually sometimes cannot make significant progress in a class period on these problems. They can become frustrated unless the teacher provides step-by-step guidance. On the other hand, students working in small groups can often handle these complex problems with little outside help.35 Teachers using student-led groups to complete exercises or hands-on activities are using the strategy of cooperating—learning in the context of sharing, responding, and communicating with other learners. Working with their peers in small groups, most students feel less self-conscious and can ask questions without feeling embarrassed. They also will more readily explain their understanding of concepts to others or recommend problem-solving approaches for the group. By listening to others in the group, students reevaluate and reformulate their own sense of understanding. They learn to value the opinions of others because sometimes a different strategy proves to be a better approach to the problem. When a group succeeds in reaching a common goal, student members of the group experience higher selfconfidence and motivation than when students work alone.

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TRANSFERRING

In a traditional classroom, the teacher's primary role is to convey facts and procedures. The students' roles are to memorize the facts and practice the procedures by working skill drill exercises and, sometimes, word problems. Students who can recall and repeat the appropriate facts and procedures score well on the end-of-unit or end-of-semester test. By contrast, in a constructivist or contextual classroom, the teacher's role is expanded to include creating a variety of learning experiences with a focus on understanding rather than memorization. Contextual teachers use the strategies discussed above (relating, experiencing, applying, and cooperating) and they assign a wide variety of tasks to facilitate learning for understanding. In addition to skill drill and word problems, they assign experiential, hands-on activities and realistic problems through which students gain initial understanding and deepen their understanding of concepts. Students who learn with understanding can also learn to transfer knowledge. Transferring is a teaching strategy that we define as using knowledge in a new context or novel situation—one that has not been covered in class.

INNOMATH Partners

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