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## Mediated learning experience during chemistry lesson

### Commentary to the film “Mediation during chemistry lesson”

Topic: modification of chemical equations

Goal: to understand the principles of how to modify chemical equations

The starting point (what do the pupils already know):

- chemical bond,
- the number of atoms in the molecule,
- the number of molecules,
- notation of chemical equation

New: principles of modification of chemical equations, conservation law for mass

For some pupils it is difficult to imagine what a chemical reaction is and how to modify chemical reaction as this content is just too abstract.

To help them to imagine and understand these key elements I decided to **use different modalities**:

- spatial model,
- pictures with colors,
- written chemical notation

To understand the chemical reactions, it is important to realize that:

- first a chemical bond has to be broken and just then new chemical bonds can be created
- only molecules as wholes can be added to equations
- it is not possible to add atoms to molecules, this would cause the change of chemical substance

In this video we can see how the teacher uses particular, content-rich topic to **support cognitive functions** such as:

- clear and detailed perception; systematic exploratory behavior; appropriate verbal tools; conservation of constancies; need for precision
- defining the problem; comparing; broad mental field; using inferential-hypothetical thinking; planning behavior
- communicate clearly the response; project virtual relationships; self-regulation, etc.



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She supports **reasoning, builds vocabulary, helps in using the previously gained knowledge** not only in chemistry but also in math or biology. New knowledge is rather built on **deducing and generalization**. **She works with the cognitive map sensitively to make the rather complex topic more understandable for pupils.**

Cognitive map of the task

Cognitive map helps us to analyze the learning experience. It uses seven aspects.

- 1) Content (the subject matter):
  - modification of chemical equations;
  - conservation law for mass;
  - number of atoms of chemical elements in molecules
  - notation of number of atoms and number of molecules
  - experiencing chemical notations
- 2) Modality (language or variety of languages used for receiving information and expressing the results):
  - Spatial model
  - Pictorial
  - Symbolic
  - Verbal
- 3) Phase of the mental act:
  - Input (data gathering)
    - Clear and detailed perception
    - Systematic exploratory behavior
    - Well-developed verbal tools
    - Conservation of constancies
    - Need for precision and accuracy in data gathering
  - Elaboration (organizing and analyzing the data)
    - Ability to identify and define the problem
    - Well-developed spontaneous comparative behavior
    - Broad mental field
    - Ability to use inferential-hypothetical thinking
    - Well-developed summative behavior
    - Well-developed planning behavior
  - Output (expressing the conclusion)
    - Ability to communicate well-elaborated responses
    - Need for precision and accuracy in communicating the response
    - Ability to project virtual relationships



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- Well-developed self-regulation and ability to avoid trial-and error response
  - Well-developed functions of visual transport
- 4) Cognitive operations (activity of the brain during the elaboration phase in order to generate new information):
- Identifying
  - Differencing
  - Counting
  - Comparing
  - Analogical thinking
  - Analyzing
  - Deducing
  - Inducing
- 5) Level of Complexity (quantity and novelty of information to be handled in a mental act)
- Moderate to high –
- New elements: notation of chemical equation, conservation law for mass
  - Need to keep in mind: the number of atoms in the molecule, the number of molecules, conservation law for mass
- 6) Abstraction (how close the mental act is to the subject at hand):
- High without the model and pictorial help
  - Thanks to different modalities lower
- 7) Efficiency (speed, accuracy, perceived level of difficulty):
- Thanks to different modalities helping to clarify the subject the efficiency is high
  - Without these modalities and clarity, the efficiency is lower or low