Name of the project:	**Digitization of chemistry experiments to improve the quality and support chemistry teaching in secondary schools**
Acronym:	**ChemIQSoc**
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Manual for chemistry teachers: how to use the videos, worksheets and tutorials from the Erasmus project

This manual provides recommendations on how to use audiovisual materials and worksheets effectively in teaching chemistry. The materials developed in the ChemIQSoc project are designed to promote innovation in teaching, increase pupils' interest in chemistry and overcome the limitations associated with laboratory equipment and the handling of hazardous substances.

Material usage options and their advantages

1. Use during theoretical chemistry lessons

- **Demonstration of complex phenomena and processes**: videos show reactions that are difficult or impossible to show in the classroom (e.g. exothermic reactions).
- **Pupil motivation**: the videos serve as a visually appealing introduction to the topic, which increases pupils' interest.
- **Improving understanding**: visual content helps to better understand the theory through real-life examples.

2. Use during laboratory exercises

- **Preparing for experiments**: videos show correct working procedures, handling of equipment and safety rules.
- **Support for under-equipped labs**: videos can replace experiments that require apparatus or chemicals that the school does not have.
- **Substitute for risky substances**: thanks to videos, reactions with toxic, mutagenic or carcinogenic substances can be demonstrated without putting pupils at risk.

3. Teaching materials for independent work

- **Worksheets**: contain questions that encourage critical thinking and independent processing of information.
- **Homework**: videos and worksheets can be used in flipped learning to prepare students for the following lessons.

Use of videos in different phases of the lesson

1. **Introduction to the lesson (motivation)**
    - Use: Videos to capture pupils' attention and introduce the topic (e.g. demonstration of a precipitation reaction).

- Benefit: They increase interest and prepare students for learning.

2. **Main part (interpretation and analysis)**
   - Use: Videos as a visual supplement to the theory or procedure of an experiment.
   - Benefit: They improve understanding through real-life demonstrations.
3. **Practical part (laboratory work)**
   - Use: Videos as a guide for conducting experiments or as an alternative when equipment is unavailable.
   - Benefit: They ensure safety and work efficiency.
4. **Conclusion (reflection and discussion)**
   - Use: Repeat the experiment on video and discuss the results.
   - Benefit: Provides space for summary and in-depth analysis.

Teaching methods

1. Flipped Learning

- Before the lesson, pupils watch videos and can solve the questions in the worksheets.
- In class, they discuss the issues and conduct experiments.
- Benefit: Improves student engagement and allows the teacher to focus on skill development.

2. Problem-Based Learning

- The teacher assigns a problem (e.g. determination of a substance by potentiometric titration), which the pupils solve based on videos and worksheets.
- Benefit: Develops analytical thinking and the ability to apply theory.

3. Demonstration

- The teacher will show videos of experiments that cannot be done in school (e.g. with carcinogenic substances).
- Benefit: It promotes safety at work by showing reactions with chemicals that secondary school pupils are not allowed to work with due to legislative restrictions.

4. Self-Learning

- Pupils independently use videos and worksheets to revise or prepare for tests.
- Benefit: Promotes independent study and an individual pace of learning.

Benefits for schools with limited equipment

- **Accessibility to modern technology**: the videos show apparatus, glassware and equipment that are not available to the school.
- **Resource saving**: no costs for consumables and chemicals.
- **Improving safety**: eliminating the risk of working with hazardous substances.

Conclusion

Using videos, worksheets and tutorials from the ChemIQSoc project offers a modern and effective way to teach chemistry. It promotes pupils' interest in the subject, develops their practical and theoretical skills and enables schools to overcome the limitations of laboratory equipment. By implementing these methods, teachers gain the tools for innovative and safe chemistry education.