

Teacher guidelines for implementing Flipped Learning in preparation for chemistry laboratory exercises

The flipped learning method allows effective use of lab time for hands-on activities and discussion. This involves preparing students with videos and work guides before the actual laboratory exercise.

The following are instructions for implementing this method.

1. Preparation before the laboratory exercise

1.1. Selection and distribution of materials

- Select materials that will help meet the lesson objectives.
- Send pupils a link to a website with videos, tutorials and worksheets.
- Provide the pupils with the necessary technical and organisational instructions.

1.2. Task assignment for pupils

- Ask pupils to watch the video and read the work instructions at home.
- Prepare a short online quiz to check pupils' understanding of the theory and steps of the experiment.
- Encourage pupils to write down questions or uncertainties as they watch the video or read the instructions.

2. During the laboratory exercise

2.1. Discussion at the beginning of the laboratory exercise

- Answer the pupils' questions.
- Highlight key aspects of the experiment and safety rules.
- Explain how the results of the experiment relate to the theory.

2.2. Use of materials during laboratory work

- Allow students access to the work instructions and videos during the lab exercise.
- Encourage them to re-watch key parts of the video on their devices as needed.

2.3. Teacher's roles during the lab exercise

- **Facilitator:** observe students, provide support and guidance as needed.
- **Motivator:** encourage teamwork and independent thinking.
- **Mentor:** point out mistakes and explain their consequences.

2.4. Reflection during the laboratory exercise

- Keep checking that pupils understand the steps of the procedure.
- Allow for discussion among pupils to implement the procedure.

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- Allow pupils to make suggestions for changes to the procedure or for improving the efficiency of the activities carried out.

2.5. Evaluation at the end of the laboratory exercise

- Ask students to compare their results with the expected values.
- Discuss the errors and possible changes to the experiment.
- Allow pupils to discuss their findings and questions that arose during the exercise.

3. After the laboratory exercise

- Pupils can create a short presentation, photo album or video of what they have learned and share it with the class.
- Motivate them to suggest how they could improve the laboratory procedure or put it into practice.

4. Technical and organisational instructions

- Check that pupils can access the videos online.
- Make sure the worksheets are printed.
- Divide the time so that pupils have sufficient space for discussion, practical activities and reflection.

Benefits of the flipped learning method in chemistry laboratory exercises

- **Efficient use of time:** pupils prepare in advance, which increases the efficiency of the lab.
- **Promoting independence:** pupils take more responsibility for their learning.
- **Deeper understanding:** the combination of theory and practice improves understanding and remembering of the material.
- This approach supports modern trends in chemistry teaching and increases pupils' interest in STEM subjects.