Teaching Laboratory Classes in the Natural Sciences (1)

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1. Planning Laboratory Classes

Overview

Clearly defined student learning outcomes are the key starting point for any planning considerations. According to Constructive Alignment (/en/start-page/teaching-learning-at-the-university/outcomes-oriented-teaching-and-learning-constructive-alignment/), the student learning outcomes should be aligned with the teaching/learning methods (esp. experiment selection) and the methods of assessment in order to create a coherent course. Furthermore, the student learning outcomes have implications for other elements of the course, for instance the questions you ask students during a laboratory class.

1. Planning considerations for course instructors

- **Selection**: What content and experimentation skills should students learn in this lab class? What experiments will you select based on these considerations (keeping in mind the available lab equipment)? What is prescribed by the curriculum? As course instructor, what is my leeway in choosing foci of the class?
- **Sequencing course content and assignments**: What sequence of experiments properly encourages step-by-step learning?
- **Integrating lecture contents into laboratory classes:** Are there elements of a lecture that can or should be explicitly referred to in a lab session? And vice versa: Should I reference specific lab content in a lecture?
- **Assessment**: What assignments allow me to assess to what extent my students achieved the student learning outcomes? What weight do I give these assignments in the overall grade? (The weight of assignments should reflect the respective weight of their corresponding student learning outcomes.)
- **Group Work** (/en/start-page/course-types-disciplines/teaching-laboratory-classes-in-the-natural-sciences/6-group-work-in-the-lab/): What is the best way to establish small groups? How do I assess group work?
- **Cooperation**: How will I organise the communication and cooperation with my co-teachers and teaching assistants? How can I provide extra support to persons who are newly employed at my department or to young teachers who just started teaching? (e.g. have regular meetings to discuss teaching, give advice and be available for questions, perhaps commit young teachers to attend specific lectures)

2. Planning considerations for co-teachers and teaching assistants

As co-teachers and TAs, you work mostly according to the specifications by the course instructor. However, you do play a key role in your students' learning process, since "experiments do not speak by themselves."[1] Your way of communicating can encourage students to think, to relate experiments to theoretical concepts, and to ask comprehension questions.

Advice for junior teachers:

If you are a first-time TA for a lab course, use your planning process as an opportunity to **perform the experiments**. You will benefit from this experience in many ways, including the following:

- You will be able to estimate better the time it takes to complete the individual steps. This knowledge will help you manage your time during the lab sessions more efficiently.
- You familiarise yourself with the equipment on site – and find out first hand which equipment works and which may not function properly. Knowing the lab setup and equipment functionality will help prepare a plan B for your class if necessary.
- You may notice misleading or missing information in the existing experiment instructions. In these cases, correct or complete the instructions in lab sessions (in oral or written form) because if anything in the instructions is unclear to you, it will also be unclear to your students.
- Performing the experiment yourself will reveal which steps contain safety risks that you need to point out to your students.
- You ask yourself the same questions that your students will ask themselves while performing experiments, e.g. how to dispose of toxic waste properly. Therefore, it will be less likely for you to be caught off guard by student questions.

For more information on preparing your first class meeting, see the entry

First Class Meeting

(https://infopool.univie.ac.at/en/home-page/teaching-learning-at-the-university/first-class-meeting/)

3. Detailed planning of experiments – further considerations:

- How should I start the session and place individual experiments in the larger (theoretical) context? How can I clarify the relationships between experiments and lectures?
- Should I demonstrate parts of an experiment? What challenges do I deliberately leave to my students to solve on their own?
- Where will my students most likely encounter difficulties while performing the experiment? How can I help them overcome these difficulties?

Continue reading

Laboratory courses (2): During an exercise (/en/start-page/course-types-disciplines/teaching-laboratory-classes-in-the-natural-sciences/2-during-the-laboratory-class/)

References

[1] Séré, Marie-Geneviève. "Towards Renewed Research Questions from the Outcomes of the European Project." In Labwork in Science Education Science Education 86, no. 5 (2002): 624-644; here: p. 638.

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