Course syllabus

Methods of Scientific Working (for Crop Sciences) (3502-440)

21 Jan 2025

Table of contents

1 Purpose and content of the course

The course provides an introduction into the theoretical and practical aspects of scientific working in the context of crop science.

Theoretical aspects include the history of science and science philosophy, the role of probability and statistics in science, and the limits of science. A high level overview of the most important concepts in these areas will be provided as foundation for the training as a scientist.

Students will learn to use tools for scientific working including the R statistical package, scientific literature databases, methods for summarizing and presenting scientific literature. The course also covers the rules and standards for good scientific working, ethical questions, the publication of scientific results and the protection of intellectual property.

In-class exercises and computer labs include an introduction into data management, statistical analysis and the critical reading of scientific texts.

Teaching methods will include recorded lectures or assigned readings before classes, group discussions and other forms of interaction during classes and in computer labs.

2 Target audience

This is a mandatory module for students of the crop science master degree program.

3 Course goals

- Students understand the historical and philosophical foundations of the scientific method.
- They are able to use this knowledge to design research projects and plan experiments that are consistent with the scientific method.
- They know and understand the importance of quantitative models and statistics in science.
- They are familiar with the basic tools necessary for good scientific work.
- Students are able to read scientific and science-related texts critically and can identify bad science or scientific nonsense.
- They are aware of the relationship between science and society.

4 Prerequisites

The course requires basic mathematical skills, but no prior knowledge of programming, or of the R statistical language.

5 Teaching concept

The course uses concepts of blended learning and is based on three pillars:

1. *Knowledge* is acquired by studying teaching material (videos, readings, exercises) before and during class
2. *Review and activation* of knowledge by communication with lecturers and peers in class
3. *Creation and construction* based on acquired knowledge in coursework

6 Class hours and room

The course schedule is posted on the course website:
http://web350b.ipsp.uni-hohenheim.de/scimeth/

The website is password-protected with username `student` and password `ws2023`.

All classes will be taught in presence on Monday from 12:00 to 14:00 and on Tuesday from 10:00 to 12:00.

Classes will be in lecture room S09, Fruwirthstrasse 21. During the first weeks of the course, there will be computer labs on Mondays in PC Room 3.

For asynchronous communication, we use the ILIAS forum for which there is a link on the course website. You are asked to post any questions or discussion items of general interest in the forum and not to send private emails to lecturers.

7 Instructors

- Prof. Dr. Karl Schmid (mailto:karl.schmid@uni-hohenheim.de), Contact hours: By appointment per Email
- MSc. Clemens Hacke (mailto:clemens.hacke@uni-hohenheim.de), Contact hours: By appointment per Email (Computer labs)

The offices of all instructors are in the Institute of Plant Breeding, Seed Science and Population Genetics (350), Fruwirthstrasse 21.

8 Credits

6 ECTS, which corresponds to 180 study hours. The workload is calculated as follows 56 (28 classes of 2 hours) contact hours, 2 hours self-study for each class (total of 56 hours) and 68 hours for coursework 1 and 2.

9 Course reading

There is no textbook for this class. All reading assignments and other material like videos will be posted on the course website. You are expected to work through some of the assigned material *before* class as indicated on the website because we will conduct interactive discussions and group work in class that is based on this material.

The schedule on the website allows you to find out which reading is assigned to each class.

10 Computing requirements

The course includes an introduction in data science using a computer and the R statistical package.

Therefore, students are required to have access to a computer. You may use your own computer to install the R statistical package and RStudio or use a web-based version of R, which only requires a browser and no installation, but a registration. You are welcome to bring your own computer to the computer labs. Guidelines for a local installation will be provided on the course website. Some computer labs will require additional R packages that should be installed before the class starts to avoid any delay. The list of required R packages will be made available on the course website and can also be found in the accompanying handouts.

11 Course website

All materials and assignments will be posted on the course website as indicated above because this is more efficient than uploading the material to ILIAS.

There will be **no** course materials on the ILIAS website. However, homework will be submitted via ILIAS on the course website.

12 Assessment

Assessment will be based on two coursework submissions and one final oral presentation with discussion. Assessment criteria will be provided separately with the instructions for each coursework.

The final grade will calculated from

- 25% Coursework 1 (Critical summary of a review paper or book chapter, in teams of two students)
- 25% Coursework 2 (Data analysis project)
- 50% Oral presentation of coursework 1 and subsequent discussion

Course grading will be anonymous to avoid bias (i.e., only your matriculation number and no names will be provided). Points for grading will be given by specific criteria described for each homework in the respective guideline document. The coursework needs to be submitted before the deadline. The graded coursework will be returned to you for your review.

The final oral presentation will include a short discussion of the coursework and some discussion questions in the context of some selected topics of the module:

- Philosophy of Science and Scientific Reasoning
- Experimental design
- Probability and statistics, Model selection
- Patenting
- Scientific ethics

The best preparation for the final oral presentation is by reviewing the key concepts of the above topics, by answering review questions and by reviewing exercises and problems for these topics discussed in class.

Assignment type	Points per assignment	Total points
Coursework 1	25	25
Coursework 2	25	25
Final oral exam	50	50
	Total:	100

The class will use +/- grading. The final grade will be determined based on the total number of points collected according to the following scale.

Total points	Grade	Grade points
95	A	1.0
90	A-	1.3
85	B+	1.7
80	B	2.0
75	B-	2.3
70	C+	2.7
65	C	3.0
60	C-	3.3
55	D+	3.7
50	D	4.0

To pass the module, you need to obtain at least 50 grade points.

13 Academic code of conduct

The course is built on the concept that student interactions are important and studying together will improve the learning experience. However, the grading of your study outputs (i.e., the homework assignments) is based on your individual work. Therefore, while you are allowed to discuss with your fellow students the general approaches to solve the problems described in your assignments, you have to do your assignments by yourself. Please note that we will check your assignments for plagiarism and if we discover evidence for it, the module will be failed. The use of large language models (LLMs) such as ChatGPT follows the guidelines of the University of Hohenheim, which can be found here: https://www.uni-hohenheim.de/en/use-of-generative-ai-in-exams, and which will be discussed in class.