



Faculty of Health, Science and Technology
Biology

Syllabus

Introduction to statistical methods in science and technology

Course Code:	7BIO002
Course Title:	Introduction to statistical methods in science and technology <i>Introduktion till statistiska metoder inom natur- och teknikvetenskap</i>
Subject:	Biology
Credits:	4 ECTS
Degree Level:	Doctoral

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology, 15 June 2022 and is valid from the autumn semester 2022.

Language of instruction

Teaching is in English or Swedish, depending on the participants' language preferences.

Prerequisites

Admission to a doctoral programme in science and technology at Karlstad University. The student is required to bring an own dataset from the doctoral project to work on during the course.

Learning Outcomes

Upon completion of the course, the doctoral students should be able to:

1. give an account of common statistical methods and study designs used in the doctoral student's research area
2. give an account of differences and similarities in statistical methods used among subjects within science and technology, as well as ethical and unethical practices in data analysis
3. apply different statistical methods to data related to the doctoral student's research project(s)

Course Content

The course covers various statistical methods in science and technology. It begins with an outline of differences and similarities among statistical methods used in different

subjects. The course focuses on frequentist statistics and hypothesis testing. The learning activities consist of a mix of lectures, workshops and seminars.

The following themes are included in the lectures:

- Overview of statistical methods – differences and similarities among subjects
- Bayesian vs frequentist statistics
- Hypothesis testing, interpretations of the p-value and effect size
- A fast-paced exposé: descriptive statistics – distributions – basic inferential statistics
- Study design
- Advanced statistical methods
- Data management
- P-hacking and other unethical data analysis approaches

At the workshops, the students work on their own dataset, with assistance from the teachers. The students present their progress and assess each other's work at the seminars.

Reading List

See separate document.

Examination

Assessment will be based on performance at the seminars, with special weight on a final, summative seminar.

Grades

One of the grades Fail (U) or Pass (G) is awarded in the examination of the course.

Quality Assurance

The course convenor has a duty to encourage a continuous dialogue on learning processes and goal fulfilment. A written evaluation is carried out at the conclusion of the course combined with a joint student-teacher discussion of all aspects commented on. The result of the evaluation is collated and made available in accordance with *The Higher Education Ordinance*, Chapter 1, § 14.

Course Certificate

Course certificate is issued on request.

Goal matrix

Goals that, after completing the course, are fulfilled for the doctoral or licentiate degree are marked with an X.

	Doctoral			Licentiate	
	Knowledge and understanding			Knowledge and understanding	
1a	- demonstrate broad knowledge and systematic understanding of the research field and			1a demonstrate knowledge and understanding in the field of research including	
1b	advanced and up-to-date specialised knowledge in a limited area of this field, and			1b current specialist knowledge in a limited area of this field as well as	
1c	familiarity with research methodology in general and the methods of the specific field of research in particular.	X		1c specialised knowledge of research methodology in general and the methods of the specific field of research in particular	X
	Competence and skills			Competence and skills	
2a	- demonstrate capacity for scholarly analysis and synthesis as well as	X		2a demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively and to	
2b	to review and assess new and complex phenomena, issues and situations autonomously and critically	X		2b plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge	X
3a	- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to			2c as well as to evaluate this work	X
3b	plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work	X		3a demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and	
4	- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research			3b society in general	

5a	- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and		4	demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.	
5b	society in general				
6	- demonstrate the ability to identify the need for further knowledge and				
7	- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.				
Judgement and approach				Judgement and approach	
8a	- demonstrate intellectual autonomy and disciplinary rectitude as well as	X	5	demonstrate the ability to make assessments of ethical aspects of his or her own research	X
8b	the ability to make assessments of research ethics, and	X	6	demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used	X
9	- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.	X	7	demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.	X