

## SYLLABUS

### APPLIED BIOSTATISTICS IN PHYSICAL EDUCATION AND SPORT SCIENCE

University year 2025-2026

#### 1. Information regarding the programme

1.1. Higher education institution	Babeş-Bolyai University
1.2. Faculty	Physical Education and Sport
1.3. Department	Doctoral School of Physical Education and Sport
1.4. Field of study	Sport Science and Physical Education
1.5. Study cycle	Doctorate/PhD
1.6. Study programme/Qualification	Doctor of Sport Sciences
1.7. Form of education	Full-time study

#### 2. Information regarding the discipline

2.1. Name of the discipline	<b>Applied Biostatistics in Physical Education and Sport Science</b>			Discipline code	<b>YD1002</b>		
2.2. Course coordinator	conf. dr. László Zoltán						
2.3. Seminar coordinator	conf. dr. László Zoltán						
2.4. Year of study	1	2.5. Semester	1	2.6. Type of evaluation	C	2.7. Discipline regime	0

#### 3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	<b>4</b>	of which: 3.2 course	<b>2</b>	3.3 seminar/laboratory	<b>2</b>
3.4. Total hours in the curriculum	<b>48</b>	of which: 3.5 course	<b>24</b>	3.6 seminar/laborator	<b>24</b>
<b>Time allotment for individual study (ID) and self-study activities (SA)</b>					<b>hours</b>
3.5.1. Learning using manual, course support, bibliography, course notes (SA)					48
3.5.2. Additional documentation (in libraries, on electronic platforms, field documentation)					48
3.5.3. Preparation for seminars/labs, homework, papers, portfolios and essays					12
3.5.4. Tutorship					12
3.5.5. Evaluations					4
3.5.6. Other activities					3
<b>3.7. Total individual study hours</b>					<b>127</b>
<b>3.8. Total hours per semester</b>					<b>175</b>
<b>3.9. Number of ECTS credits</b>					<b>7</b>

#### 4. Prerequisites (if necessary)

4.1. curriculum	Not applicable
4.2. competencies	<ul style="list-style-type: none"> <li>• User-level computing skills (medium-level)</li> <li>• Speaking and writing skills in English (medium-level)</li> <li>• Basic knowledge of mathematics</li> </ul>

#### 5. Conditions (if necessary)

5.1. for the course	Audio-video logistics, whiteboard, access to WiFi internet
5.2. for the seminar /lab activities	Audio-video logistics, whiteboard, access to WiFi internet

#### 6.1. Specific competencies acquired

<b>Professional/essential competencies</b>	<ul style="list-style-type: none"> <li>• Competences in designing scientific studies, both on the field and in the laboratory</li> <li>• Competences in collecting, analyzing and interpreting scientific data</li> <li>• Programming, data analysis and data visualization competences in the R statistical environment</li> </ul>
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<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>Competences in the statistical analysis of data, a requisite of scientific research in any field which involves a quantitative approach</li> </ul>
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## 6.2. Learning outcomes

<b>Knowledge</b>	The student knows to perform a statistical analysis in R
<b>Skills</b>	The student is able to calculate, compute and program in R
<b>Responsibility and autonomy:</b>	The student has the ability to work independently for a research project or any field of biology which includes data analysis

## 7. Objectives of the discipline (outcome of the acquired competencies)

<b>7.1 General objective of the discipline</b>	<ul style="list-style-type: none"> <li>To gain quantitative analytical skills of biological data in the R statistical environment</li> </ul>
<b>7.2 Specific objective of the discipline</b>	<ul style="list-style-type: none"> <li>To learn to design scientific studies and to collect data in biology and ecology, both in the laboratory and on field</li> <li>To learn to analyze data using the adequate statistical tests, as implemented in the R statistical environment</li> <li>To learn to visualize data using plotting tools implemented in R</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1. Statistical thinking and research planning: role of statistics in PhD research, importance of early planning, statistical workflow and reproducibility.	Presentation, discussion, case studies	2 hours
2. Hypotheses, predictions, and data types: types of hypotheses and predictions, scales of measurement, review of core statistical concepts.		
3. Data structures and descriptive statistics: data tables, data frames, databases, variable types and characteristics, descriptive statistics and distribution moments.		
4. Probability distributions and GOF: frequency and density distributions, common theoretical distributions, GOF tests and interpretation.		
5. Simulation and stochastic approaches: simulation of random vectors, Monte Carlo methods, introduction to Markov chains, role of simulation in research.		
6. Statistical inference frameworks: frequentist inference, parametric vs. non-parametric methods, assumptions, robustness, and limitations.		
7. Parametric methods for group comparisons: differences between group means, independent and repeated measures designs, z- and t-tests, clinical trial logic.		
8. Non-parametric methods and study planning: non-parametric alternatives, implications for power, design, and interpretation.		
9. Principles of experimental design: randomization, blocking, control, bias, and confounding in experimental research.		
10. General linear models: concept of the general linear model, ANOVA and linear regression, variable structures in PhD research.		
11. Generalized linear models: extensions of linear models, Poisson and binomial regression, interpretation of model parameters.		
12. Reporting and communicating statistical results: structure of the results section, linking analyses to hypotheses, transparency and reproducibility.		
Bibliography (1) Newell, J., Aitchison, T., & Grant, S. (2014). Statistics for sports and exercise science: a practical approach. Routledge. (2) Williams, C., & Wragg, C. (2004). Data analysis and research for sport and exercise science: a student guide. Routledge. (3) Okoye, K., & Hosseini, S. (2024). R Programming: Statistical Data Analysis in Research. Springer Nature.		
8.2 Seminar / laboratory	Teaching methods	Remarks

1. R environment and project setup: R projects, scripts, packages, linking individual PhD research questions to statistical analyses.	Practical work. Problem-solving and discussion	2 hours
2. Operationalizing hypotheses in R: coding variables, inspecting data structures, translating research questions into testable hypotheses.		
3. Data import, cleaning, and exploration: building data frames, descriptive statistics, exploratory data analysis using students' data or realistic mock datasets.		
4. Visualizing and testing distributions: plotting empirical distributions, fitting theoretical distributions, GOF testing in R.		
5. Data simulation and uncertainty exploration: simulating datasets based on literature parameters, Monte Carlo simulations, exploring variability and uncertainty.		
6. Assumption checking and test selection: testing normality, homoscedasticity, and independence, choosing parametric or non-parametric methods.		
7. Implementing parametric tests in R: group comparisons, independent and repeated measures analyses, effect sizes and confidence intervals.		
8. Non-parametric analyses and power exploration: applying non-parametric tests, simulating power and sample size scenarios for planned studies.		
9. Experimental design in practice: implementing randomization and blocking, evaluating and improving experimental designs through simulation.		
10. Linear models in R: fitting ANOVA and regression models, diagnostics and interpretation applied to PhD research data.		
11. Generalized linear models in R: fitting Poisson and binomial models, model comparison, interpretation in applied research contexts.		
12. Reproducible reporting and results writing: generating tables and figures, writing results sections, producing reproducible reports (e.g., Sweave or knitR).		
Bibliography (1) Newell, J., Aitchison, T., & Grant, S. (2014). Statistics for sports and exercise science: a practical approach. Routledge. (2) Williams, C., & Wragg, C. (2004). Data analysis and research for sport and exercise science: a student guide. Routledge. (3) Okoye, K., & Hosseini, S. (2024). R Programming: Statistical Data Analysis in Research. Springer Nature.		

**9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program**

<ul style="list-style-type: none"> <li>The course has a similar content to courses from other European universities, and considers the level of training and abilities of doctoral students</li> <li>The content of the course is regularly updated and incorporates the most novel approaches from the field of statistics</li> <li>The course is fundamental for doctoral students, as quantitative skills are essential for scientific research activities</li> </ul>
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**10. Evaluation**

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Activity during seminars	Individual projects	100%
10.5 Seminar/laboratory			
10.6 Minimum standard of performance <ul style="list-style-type: none"> <li>Knowledge of 50% of the information content of the course</li> <li>Knowledge of 50% of the information content of the laboratory work</li> </ul>			

**11. Labels ODD (Sustainable Development Goals)**

	General label for Sustainable Development							
								

Date: 04. 05. 2025

Signature of course coordinator

Signature of seminar coordinator

Conf. Dr. László Zoltán

Conf. Dr. László Zoltán

Date of approval:

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Signature of the head of department

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