Module Code	PSU33015
Module Name	Statistics and Methodology III
ECTS credit weighting	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Rhodri Cusack, Kevin Campion
Module Learning Outcomes with embedded Graduate Attributes	**On successful completion of this module, students will be able to:** LO1. Screen raw, messy datasets for missing data, errors and other issues, and select and justify methods for handling these issues [TI, DC]. LO2. Select, fit and interpret appropriate statistical models, considering the research question and the structure of the data. Models covered include linear and logistic regression, ANOVA/ANCOVA (with post-hoc tests), and mixed-effects models [TI, DC]. LO3. Estimate the size of an observed effect using effect sizes, interpret confidence intervals, plan sample sizes with power analyses, and interpret meta-analyses [TI]. LO4. Apply bootstrapping (e.g., for confidence intervals) and permutation tests as alternatives to parametric methods [TI]. LO5. Formulate a research question based on published literature, specify an analysis plan and implement it on a large secondary dataset [TI, AR]. LO6. Report statistical results, tables and figures in APA style, in both written and oral form [CE]. LO7. Work in a research team: contribute to a shared report, give peer review and implement it for their own project [CE, AR, DC]. This module primarily develops the Trinity Graduate Attribute "To Think Independently" [TI] through the design and execution of an original analysis of secondary data (LO1–LO5). "To Communicate Effectively" [CE] is developed through written reports and the group presentation (LO6), "To Act Responsibly" [AR] through the ethical handling of secondary data and contribution to a group project (LO5, LO7), and "To Develop Continuously" [DC] through completing fortnightly Python notebooks (LO1–LO4).

Module Content	This module teaches students the skills they will need to carry out quantitative research of their own: taking a real dataset from its raw, messy state to a reported result by cleaning it, selecting and running appropriate analyses, and writing up and presenting what they find. **Lecture topics:** • Dealing with messy and missing data • Effect sizes, confidence intervals and statistical power • Linear and Logistic regression, classification • ANOVA, ANCOVA and post-hoc comparisons • Mixed-effects models • Bootstrapping and permutation tests • Meta-analysis
Teaching and Learning Methods[1]	**Teaching strategies** This module is delivered through weekly one-hour lectures and one-hour computer labs. Lectures introduce statistical concepts and methods using examples from instructive published papers. Concepts and methods are then illustrated and practised in fortnightly Python notebooks, worked on in the computer lab. Students also use lab time to work with their group on the term-long research project, with module coordinator on hand for feedback. Material is therefore met at least twice, in the lecture and in a notebook, and likely a third time in the group project, where relevant to a group's own analysis. Additionally, a revision lecture with mock exam questions is held towards the end of the semester. Each notebook is designed to take 60–80 minutes. New coding concepts and functions are introduced with a related worked example before students are asked to use them. As a result, coding is scaffolded while still requiring students to think independently. Each notebook is supported across two labs and in office hours. The group project is structured as staged deliverables (selecting a research question, reviewing the literature, formulating an analysis plan, and so on). Group work is organised through Blackboard Groups and a shared OneNote with tracked changes. **Assessment design** Notebooks are assessed as submitted or not submitted, so students can practise each method from the lectures before applying it in the group report or being examined on it individually (LO1–LO4). The group project is staged so that groups receive feedback on each deliverable before the next is due and the peer-review stage requires them to

[1] Trinity-INC provides tips and resources on how to make your curriculum more inclusive.

evaluate another group's work and act on the comments they receive (LO5–LO7). The final exam is open-book, as the focus is on the ability to choose, run and interpret an analysis (LO1–LO4, LO6).

Education for Sustainable Development (ESD) Themes and Competencies

The group project uses national survey data on health and wellbeing (Healthy Ireland, TILDA), energy use (SEAI) and social attitudes and inequality (ESS10, CSPPA), so most research questions fall under the ESD themes of Society (SDGs 3 and 10) and Economy (SDG 7). Through working on this project, students develop three ESD competencies in particular: critical thinking, as they have to judge what an analysis can and cannot show (LO1–LO4); integrated problem-solving, as they have to formulate a research question and analysis plan, and implement it on a real dataset (LO5); and collaboration (LO7).

Assessment Details[2]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**

It is recommended that module co-ordinators consider assessment types used across the year to ensure varied assessment methods.

Assessment Component	Assessment Description	LO Addressed	% of total
Continuous assessment: four individual Python notebooks	Fortnightly Python notebooks covering lecture topics (e.g., data screening and missing data; ANOVA and mixed-effects models etc.) Each notebook assessed as submitted (2.5%) or not submitted (0%).	LO1–LO4	10%
Group research project	Groups of 6–7 select a dataset and submit a literature review, an analysis plan, an APA-format scientific	LO1–LO7	60%

[2] https://www.tcd.ie/academicpractice/resources/assessment/

	report, a structured peer review of another group's work, and an oral presentation. Datasets are provided by the Irish Social Science Data Archive or European Social Survey.		
In-person open-book examination	Computer-based exam in the form of a Python notebook. Students clean, analyse and interpret data individually. Notes and module materials are permitted.	LO1–LO4, LO6	30%
Formative assessment	Staff support in weekly labs, feedback on each group project deliverable, peer review between groups, mock exam questions with worked answers	LO1–LO7	—

Academic integrity and generative AI

Each assessed component carries a level from the Centre for Academic Practice's five-level traffic-light model, stated in the assignment brief. The exam is Level 1 (red, prohibited): it is sat in person under invigilation and requires students to run and interpret analyses on the day. The notebooks are Level 3 (yellow, permitted as research/learning tool, all use disclosed). The group project report is Level 2 (orange, restricted to grammar checking, brainstorming) and group presentation is Level 1 (prohibited). Group work is developed in a shared OneNote with tracked changes, so each student's contribution to the report is visible.

Contact Hours and Indicative Student Workload[3]

Consider how much time an average student needs to invest in the elective to demonstrate the learning outcomes at threshold level. Take into account attendance and time for preparation, including self-study, for all teaching, learning and assessment associated with the module. Workload should be commensurate with ECTS size, which is equivalent to 100-125 student learning hours.

Contact hours: 22 hours (11 × 1-hour lectures and 11 × 1-hour computer labs)
Independent Study (preparation for course and review of materials): 40 hours
Independent Study (preparation for assessment, incl. completion of assessment): 63 hours (four notebooks, approx. 8 hours; group project, approx. 40 hours per student; exam revision, approx. 15 hours)

Inclusive Curriculum

All modules should be inclusive for all students who learn differently. Please respond to the following questions (i.e. ensuring the course supports engagement and representation of all students)

	PLEASE TICK
1. Have you reviewed the teaching / assessment methods and materials for possible barriers to learning, e.g. students with English as a second language, disabilities, significant external responsibilities, students with IT issues / requiring specific accessibility software etc.?	☒
2. Have you adapted your resources and teaching materials taking into account Trinity's Accessible Information Guidelines (https://www.tcd.ie/disability/teaching-info/TIC/materials.php)?	☒
3. Does the content of your module address diversity? For example, including a diverse demographic profile of authors, diversity of ideas and perspectives, or representation (e.g. pictures of conditions on different skin tones), or by acknowledgement of the homogenous context of the discipline/topic?	☒
4. Highlight at least two ways which your course/module incorporates principles of inclusivity and accessibility into the curriculum design *(i.e. supports engagement and representation of* ***all*** *Trinity students, presents information and content in a variety of ways, and offers variety and options of assessment type. See:* Universal Design for Learning - AHEAD *for more information and guidance, and* Inclusive Curriculum - Equality - Trinity College Dublin (tcd.ie) *for insights from Trinity students)*	

[3] https://www.tcd.ie/academicpractice/resources/assessment_workload/

	1. Accessible and flexible learning materials Lecture slides, notebooks and lab materials are released on Blackboard in advance. All programming is done in Google Colab in a standard web browser: there is nothing to install and license required. Colab runs on college machines and on low-specification personal laptops, and students can use their own accessibility settings and software. **2. Scaffolded programming** Each notebook introduces every new function with a worked example immediately before it is needed, is designed to take no more than 80 minutes, and is supported across two labs and in office hours, so students with limited programming confidence are not disadvantaged. **3. Variety of assessment formats** Learning is demonstrated through four formats: short practical notebooks, an extended written group report, an oral presentation and an open-book exam. The open-book format removes memorisation load, the submitted/not-submitted notebooks keep early practice low-stakes, and group roles let students contribute through coding, writing or presenting. **4. Diverse content** The group project datasets are national surveys on ageing, health, energy use and social attitudes, so the questions students investigate concern different groups within the Irish population.
Indicative Reading List (approx. 4-5 titles)	There is no single core textbook for this module. The recommended text is: Poldrack, R. A. (2025). Statistical thinking: Analyzing data in an uncertain world. Princeton University Press. An earlier version is freely available online as Statistical Thinking for the 21st Century (statsthinking21.org). Additional readings for each lecture will be made available on Blackboard.
Module Pre-requisite	PSU11011, PSU22011
Module Co-requisite	None
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No