London Interdisciplinary Social Science Doctoral Training Partnership

Advanced Research Methods in Social Sciences

Course Code & Title	**LISS005 Introduction to Quantitative Research**			
Convenor(s)	Dr Yang Ye, School of Human Sciences, the University of Greenwich Email: y.ye@gre.ac.uk			
Institution	Combined		**Department**	LISS DTP
Academic Year	2023/2024		**Term**	Summer
Number of sessions	10	**Research Platform**	Quantitative Research	**Length of Session(s)**	2 hr lecture 1 hr seminar

Day, Date	Start : End	Room Location
Lecture 1: May 24 (Friday) Lecture 2: May 28 (Tuesday) Lecture 3: May 31 Lecture 4: June 4 Lecture 5: June 7 Lecture 6: June 11 Lecture 7: June 14 Lecture 8: June 18 Lecture 9: June 21 Lecture 10: June 25	13:00 to 16:00	Online (Zoom) – URL available upon enrolment

Enrolment Links:	Available to book on SkillsForge from **Tuesday 2 April 2024**. Click to log in and register: https://training.kcl.ac.uk/kcl/#he/dev/eventDetails,;em,providerCode=LISS,providerOrgAlias=kcl,number=005,; Questions? Visit our Training FAQ here: Frequently Asked Questions - LISS DTP (liss-dtp.ac.uk)

* Please note this course has 10 sessions in 2024*

Course Description:

The main purpose of this course is to introduce students to the fundamentals of statistical reasoning, descriptive and inferential statistics and research design, on which the students can further develop their statistics and data analysis skills. It does not assume any prior knowledge in statistics. The only prerequisite is basic algebra. Those who took their statistics courses a while ago (e.g., during undergraduate) and need to refresh their knowledge about the fundamentals of frequency-based statistics may also find this course helpful.

The course uses 1) Microsoft Excel for demonstrating the mathematical algorithms and procedures behind various statistical procedures and 2) IBM SPSS (https://www.ibm.com/uk-en/products/spss-statistics) for inferential statistics. I will also introduce the application of free AI tools such as ChatGPT in conducting data analysis, or facilitating data analysis in SPSS.

The course uses materials from the open course "Statistical Reasoning" from Carnegie Mellon University under the Creative Commons Attribution: Non-commercial Share Alike 4.0 License, Copyright 2020 Open Learning Initiative.

Course Schedule:

Session	Lecture topic	Practical seminar topic	Unit
1	Distribution	Depicting a variable	Unit 1: Depicting quantitative data
2	Covariation	Depicting relationship	
3	Probability	Using normal distribution	Unit 2: Probability and sampling
4	Sampling	Sampling distribution	
5	Statistical estimation	Confidence interval	Unit 3: Statistical inference
6	Hypothesis testing: Part 1	Chi-square test	
7	Hypothesis testing: Part 2	T-test and analysis of variance (ANOVA)	
8	Hypothesis testing: Part 3	Correlation and regression Using AI (e.g., ChatGPT) for data analysis	
9	Research design and validity	Power analysis	Unit 4: Research design
10	Measurement related issues	Open science and research practice	

Course Outline:

Unit 1: Depicting quantitative data

In this unit we will learn about the basics of quantitative data. We will start with the concept of quantification: turning observations of real-life phenomena into numbers. We will then learn a few key data-related concepts: variable, distribution, and co-variation. We will study how to depict a simple variable using statistics or graphics, and how to depict the relationship between two variables.

Lecture 1: Distribution

- Overview of the course
- Variable
    - Categorical variable
    - Quantitative variable
- Distribution
    - Graphic depictions
    - Numerical descriptions

Keywords: variable, distribution, mean, standard deviation, median, mode, range

Lecture 2: Covariation

- Depicting relationships
    - Categorical and categorical variables
    - Categorical and quantitative variables
    - Quantitative and quantitative variables

Keywords: two-way table, boxplot, scatterplot

Unit 2: Probability and sampling

In this unit we will learn about the probability. We will have a brief overview about the basics about probability. We will then learn about how we could make highly precise conclusions about a large population while only having access to small samples - where the power of statistics lies.

Lecture 3: Probability

- Relative frequency
- Probability distribution
    - Random variables
    - Normal distribution

Keywords: probability, random variable, normal distribution

Lecture 4: Sampling

- Sampling methods

- Sampling distribution
  - The behaviour of sample mean
  - Sample size
  - The central limit theorem

Keywords: sampling bias, standard error, central limit theorem

Unit 3: Statistical inference

In this unit we will learn about how to make statistical estimations and to conduct statistical analysis that test hypotheses about the relationship between IV(s) and DVs.

Lecture 5: Statistical estimation

- Point estimation
- Interval estimation

Keywords: sample statistics, population parameters, confidence intervals

Lecture 6: Hypothesis testing: Part 1

- The NHST paradigm
  - Null and alternative hypotheses
  - The four steps of hypothesis testing
  - P-value
  - Type 1 and Type 2 Error
  - Statistical power
- Testing C-C relationship
  - Chi-square test

Keywords: null hypothesis, alternative hypothesis, p-value, testing statistics, statistical power

Lecture 7: Hypothesis Testing: Part 2

- Testing C-Q relationship
  - Independent t-test
  - Paired t-test
  - Complete randomised analysis of variance (ANOVA)
  - Two factor complete randomised ANOVA
  - Test of simple effects and interaction effects

Keywords: t-test, ANOVA, post-hoc comparison

Lecture 8: Hypothesis Testing: Part 3

- Testing Q-Q relationship
  - Bi-variate correlation
  - Bi-variate regression

- o   Multiple regression with two independent quantitative IVs
- o   Multiple regression with a 2-way interaction between two quantitative IVs

Keywords: interaction, simple effects, Pearson's correlation, bivariate regression

Unit 4: Research Design

In the final unit we will learn about the fundamentals of research design and quantitative measurement.

Lecture 9: Research design and validity

- o   Internal validity and confounding variable
- o   External validity
- o   Experimental design
- •   Keywords: internal and external validity, confounding variable

Lecture 10: Measurement related issues

- o   Levels of measurement
- o   Measurement reliability
- o   Measurement validity
- •   Open science and research practice

Keywords: measurement validity and reliability

Useful link

- -   The Open Course "Statistical Reasoning" at Open Learning Initiative: https://oli.cmu.edu/courses/statistical-reasoning-copy/
- -   My statistics teacher Dr. Bob Gardner's (Professor Emeritus, Western University, Canada) webpage of data analysis and materials from his Psychology 9540 course: http://publish.uwo.ca/~gardner/DataAnalysisDotCalm/

About the course instructor:

Dr. Yang Ye is a Senior Lecturer in Psychology at the School of Human Sciences, University of Greenwich, where he teaches statistics, research methods and social psychology. Yang received his PhD in Social Psychology at Western University, Canada. Before joining the University of Greenwich, he did post-doctoral research in experimental psychology at Ghent University, Belgium and in sociolinguistics at Queen Mary University of London. His research topics include attitudes, stereotype and bias in judgments and perceptions.