



## COURSE OUTLINE

# SCI110 Science Research Methods

**Course Coordinator:** Peter Dunn (pdunn2@usc.edu.au) **School:** School of Science, Technology and Engineering

2021 | Semester 1

USC Sunshine Coast  
USC Moreton Bay

**ON CAMPUS**

Most of your course is on campus but you may be able to do some components of this course online.

Online

**ONLINE 1**

You can do this course without coming onto campus.

*Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.*

## 1. What is this course about?

### 1.1. Description

The course introduces you to the essential components of scientific research design and statistical methods that can be used to summarise, analyse and interpret scientific data. Practical examples across all of the scientific disciplines are used in lectures and tutorials.

### 1.2. How will this course be delivered?

| ACTIVITY  | HOURS | BEGINNING WEEK | FREQUENCY |
|---|-------|----------------|-----------|
| <b>ON CAMPUS</b>                                |       |                |           |
| <b>Lecture</b> – Online                         | 2hrs  | Week 1         | 13 times  |
| <b>Tutorial/Workshop</b> – Blended              | 2hrs  | Week 1         | 13 times  |
| <b>ONLINE 1</b>                                 |       |                |           |
| <b>Lecture</b> – Online                         | 2hrs  | Week 1         | 13 times  |
| <b>Tutorial/Workshop</b> – Online zoom tutorial | 2hrs  | Week 1         | 13 times  |

### 1.3. Course Topics

- Quantitative research questions: Population, Outcome, Comparison/Connection, Intervention.
- Design features of quantitative observational and experimental studies:
  - External validity: random and non-random sampling;
  - Internal validity, including Hawthorne effect, observer effect, units of observation and units of analysis, etc.
- Data collection, including the use of protocols.
- Data descriptions: Nominal and ordinal qualitative data; discrete and continuous data.
- Graphical analyses, including bar charts, pie charts, histograms, stem-and-leaf plots, dot plots, side-by-side bar charts, stacked bar charts, boxplots, error bar charts and scatterplots.
- Numerical analyses, including medians, means, standard deviations, IQRs, percentages, odds, odds ratios, correlations, simple linear relationships.
- Statistical analyses:
  - Confidence intervals: for one mean, a mean difference, a difference between means, the odds ratio, regression parameters;
  - Hypothesis tests: one-sample *t*-tests, paired sample *t*-tests, two sample *t*-test, chi-squared tests of independence, correlation, *t*-tests for regression parameters.
- Normal distributions, the 68-95-99.7 rule, and z-scores.
- Basic probability and independence.
- The language of research and statistics.
- Ethics in planning, interpreting and reporting the results of quantitative studies, including academic integrity and ecological validity .
- Reading and writing research.

## 2. What level is this course?

100 Level (Introductory)

Engaging with discipline knowledge and skills at foundational level, broad application of knowledge and skills in familiar contexts and with support. Limited or no prerequisites. Normally, associated with the first full-time study year of an undergraduate program.

## 3. What is the unit value of this course?

12 units

## 4. How does this course contribute to my learning?

| COURSE LEARNING OUTCOMES  | GRADUATE QUALITIES   |
|---|--|
| On successful completion of this course, you should be able to...   | Completing these tasks successfully will contribute to you becoming... |
| 1 Develop quantitative research questions and testable hypotheses.  | Empowered  |
| 2 Design quantitative studies to answer simple scientific research questions.                                     | Empowered  |
| 3 Select and produce the appropriate graphical, numerical and statistical analyses.                               | Knowledgeable  |
| 4 Select, apply and interpret the results of the appropriate statistical technique to analyse scientific data.    | Empowered  |
| 5 Comprehend, apply, and communicate in the language of research and statistics.                                  | Knowledgeable<br>Empowered   |
| 6 Demonstrate professional integrity in planning, interpreting and reporting the results of quantitative studies. | Ethical  |

## 5. Am I eligible to enrol in this course?

Refer to the [USC Glossary of terms](#) for definitions of “pre-requisites, co-requisites and anti-requisites”.

### 5.1. Pre-requisites

Not applicable

### 5.2. Co-requisites

Not applicable

### 5.3. Anti-requisites

SCI201 or CPH261

### 5.4. Specific assumed prior knowledge and skills (where applicable)

Basic mathematical skills are assumed.

## 6. How am I going to be assessed?

### 6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

### 6.2. Details of early feedback on progress

Early feedback is provided through Revision Quiz 1.

### 6.3. Assessment tasks

| DELIVERY MODE | TASK NO. | ASSESSMENT PRODUCT                | INDIVIDUAL OR GROUP | WEIGHTING % | WHAT IS THE DURATION / LENGTH?   | WHEN SHOULD I SUBMIT?                        | WHERE SHOULD I SUBMIT IT?                          |
|---------------|----------|-----------------------------------|---------------------|-------------|--|--|--|
| All           | 1        | Quiz/zes                          | Individual          | 25%         | N/A  | Throughout teaching period (refer to Format) | Online Assignment Submission                       |
| All           | 2a       | Plan                              | Group               | 15%         | Completed pro forma  | Refer to Format                              | Online Assignment Submission with plagiarism check |
| All           | 2b       | Report                            | Group               | 20%         | Recommended max. of 26 slides (plus required software output in Word document) | Refer to Format                              | Online Assignment Submission with plagiarism check |
| All           | 3        | Examination - Centrally Scheduled | Individual          | 40%         | Two hours  | Exam Period                                  | Online Test (Quiz)                                 |

#### All - Assessment Task 1: Revision Quizzes

|                 |  |
|-----------------|--|
| <b>GOAL:</b>    | To enable you to practice the skills and revise the content studied each week in directed study activities.  |
| <b>PRODUCT:</b> | Quiz/zes   |
| <b>FORMAT:</b>  | Submit by 4pm Friday of Weeks 4, 7, 9, 11 and 13.<br><br>Complete the quizzes in your own time.<br>Unlimited attempts are permitted at each quiz.<br>Your highest mark will be recorded.<br>Each quiz is worth 5%. |

| CRITERIA: | No. | Learning Outcome assessed   |
|-----------|-----|---|
|           | 1   | Design appropriate scientific studies to answer simple scientific research questions.   |
|           | 2   | Select and apply the correct statistical technique to analyse scientific data   |
|           | 3   | Select, apply and interpret the results of the appropriate statistical technique to analyse scientific data                         |
|           | 4   | Comprehend, apply, and communicate in the language of research and statistics (including using graphical and numerical information) |
|           | 5   | Demonstrate professional integrity in planning, interpreting and reporting the results of scientific studies                        |
|           | 6   | Assessment criteria are mapped to the course learning outcomes.   |



### All - Assessment Task 2a: Project

| <b>GOAL:</b>     | To enable you to engage with all stages of the scientific research process, include planning, design, data collection, data summarising, data analysis, and reporting  |     |                           |   |                                       |   |  |   |  |   |   |   |  |
|------------------|--|-----|---------------------------|---|---------------------------------------|---|--|---|--|---|---|---|--|
| <b>PRODUCT:</b>  | Plan   |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| <b>FORMAT:</b>   | <p>Submit by 4pm Friday of Week 6.</p> <p>Completed Pro Forma articulating your project plan and design.</p> <p>Further details will be available on Blackboard.</p> <p>This Task should be completed in a group of no more than five students. Your group members should, as far as possible, belong to the same tutorial.</p>  |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| <b>CRITERIA:</b> | <table border="1"> <thead> <tr> <th>No.</th> <th>Learning Outcome assessed</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Ability to develop research questions</td> </tr> <tr> <td>2</td> <td>Ability to design scientific studies to answer simple scientific research questions.</td> </tr> <tr> <td>3</td> <td>Select and produce the appropriate graphical, numerical and statistical analyses</td> </tr> <tr> <td>4</td> <td>Comprehend, apply, and communicate in the language of research and statistics</td> </tr> <tr> <td>5</td> <td>Demonstrate professional integrity in planning the results of scientific studies</td> </tr> </tbody> </table> | No. | Learning Outcome assessed | 1 | Ability to develop research questions | 2 | Ability to design scientific studies to answer simple scientific research questions. | 3 | Select and produce the appropriate graphical, numerical and statistical analyses | 4 | Comprehend, apply, and communicate in the language of research and statistics | 5 | Demonstrate professional integrity in planning the results of scientific studies |
| No.              | Learning Outcome assessed  |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| 1                | Ability to develop research questions  |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| 2                | Ability to design scientific studies to answer simple scientific research questions.   |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| 3                | Select and produce the appropriate graphical, numerical and statistical analyses   |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| 4                | Comprehend, apply, and communicate in the language of research and statistics  |     |                           |   |                                       |   |  |   |  |   |   |   |  |
| 5                | Demonstrate professional integrity in planning the results of scientific studies   |     |                           |   |                                       |   |  |   |  |   |   |   |  |

### All - Assessment Task 2b: Project

|                 |   |
|-----------------|---|
| <b>GOAL:</b>    | To enable you to engage with all stages of the scientific research process, include planning, design, data collection, data summarising, data analysis, and reporting.  |
| <b>PRODUCT:</b> | Report  |
| <b>FORMAT:</b>  | <p>Submit by 4pm Friday of Week 12:</p> <p>(i) A PowerPoint presentation reporting on your project; and<br/>(ii) a Word document giving software output and related information.</p> <p>Further details will be available on Blackboard.</p> <p>This Task should be completed in a group of no more than five students. Your group members should, as far as possible, belong to the same tutorial.</p> |

| CRITERIA: | No. | Learning Outcome assessed   |
|-----------|-----|---|
|           | 1   | Develop research questions and testable hypotheses  |
|           | 2   | Design scientific studies to answer simple scientific research questions.                                     |
|           | 3   | Select and produce the appropriate graphical, numerical and statistical analyses                              |
|           | 4   | Select, apply and interpret the results of the appropriate statistical technique to analyse scientific data   |
|           | 5   | Comprehend, apply, and communicate in the language of research and statistics                                 |
|           | 6   | Demonstrate professional integrity in planning, interpreting and reporting the results of scientific studies. |

### All - Assessment Task 3: Final examination

| <b>GOAL:</b>    | To review and consolidate all of the key content in the course.  |   |
|-----------------|--|---|
| <b>PRODUCT:</b> | Examination - Centrally Scheduled  |   |
| <b>FORMAT:</b>  | Multiple choice examination questions. Your examination will be open book: any non-electronic materials are permitted. Any calculator is permitted that is not a communication device. |   |
| CRITERIA:       | No.  | Learning Outcome assessed   |
|                 | 1  | Write research questions and testable hypotheses  |
|                 | 2  | Design appropriate scientific studies to answer simple scientific research questions.   |
|                 | 3  | Produce graphical, numerical and statistical analyses (using computer software and by hand)   |
|                 | 4  | Select and apply the correct statistical technique to analyse scientific data   |
|                 | 5  | Comprehend, apply, and communicate in the language of research and statistics (including using graphical and numerical information) |
|                 | 6  | Show professional integrity in planning, interpreting and reporting the results of scientific studies                               |

## 7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

## 8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site– Please log in as soon as possible.

### 8.1. Prescribed text(s) or course reader

Please note that you need to have regular access to the resource(s) listed below. Resources may be required or recommended.

| REQUIRED? | AUTHOR     | YEAR | TITLE   | PUBLISHER     |
|-----------|------------|------|---|---------------|
| Required  | P. K. Dunn | 2021 | Scientific Research Methods: Tutorials  | Online (free) |
| Required  | P. K. Dunn | 2021 | Scientific Research Methods An introduction to quantitative research and statistics in science and health | Online (free) |

## 8.2. Specific requirements

You need access to a calculator with statistical functionality. Examples include, but are not limited to: Casio FX100AU Scientific Calculator; Casio FX82 AU PLUS-BP Scientific Calculator; Sharp EL531WHBLK Scientific Calculator.

You need access to statistical software, such as jamovi (recommended) or IBM SPSS Statistics (commonly called SPSS). You only need access to one of these programs.

- jamovi is available as a free download from <https://www.jamovi.org/>. We advise downloading the solid version (rather than the current version) as it is likely to be more stable.
- SPSS is available in most USC computer laboratories, and through USCAnywhere ([anywhere.usc.edu.au](http://anywhere.usc.edu.au)) from any internet-enabled device. You do not need to purchase SPSS.

## 9. How are risks managed in this course?

Health and safety risks for this course have been assessed as low. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the health and safety risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training for students](#), and following the instructions of the University staff.

## 10. What administrative information is relevant to this course?

### 10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

### 10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

- a. The final mark is in the percentage range 47% to 49.4%
- b. The course is graded using the Standard Grading scale
- c. You have not failed an assessment task in the course due to academic misconduct.

### 10.3. Assessment: Submission penalties

Late submission of assessment tasks may be penalised at the following maximum rate:

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day - 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task. Weekdays and weekends are included in the calculation of days late. To request an extension you must contact your course coordinator to negotiate an outcome.

### 10.4. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au).

### 10.5. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email [studentwellbeing@usc.edu.au](mailto:studentwellbeing@usc.edu.au) or call 07 5430 1226.

## 10.6. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email [AccessAbility@usc.edu.au](mailto:AccessAbility@usc.edu.au) or call 07 5430 2890.

## 10.7. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website: <http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

## 10.8. General Enquiries

### In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **USC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

**Tel:** +61 7 5430 2890

**Email:** [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au)