

Preregistration

Author

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Credit statement and licence

Possible roles using the CRediT contribution system:

- **Conceptualization:** Ideas; formulation or evolution of overarching research goals and aims
- **Methodology:** Development or design of methodology; creation of models
- **Software :** Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components
- **Validation:** Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs
- **Formal analysis:** Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data
- **Investigation:** Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection
- **Resources:** Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools
- **Data Curation:** Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse
- **Writing - Original Draft:** Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
- **Writing - Review & Editing:** Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre-or postpublication stages
- **Visualization:** Preparation, creation and/or presentation of the published work, specifically visualization/ data presentation

- **Supervision:** Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
 - **Project administration:** Management and coordination responsibility for the research activity planning and execution
 - **Funding acquisition:** Acquisition of the financial support for the project leading to this publication
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Prerequisites

! Prerequisites

Before completing this submodule, please carefully read about the necessary prerequisites.

Prerequisite	Description	Link/Where to find it
Topic Name	Basic intro to X	Module + Submodule
Software Name	Configuring the environment	Download Link

Questions from previous submodule

- **Aim:** This first slide is dedicated to clarifying questions from the previous submodule and/or to discuss assignments.
 - Additional slides may need to be added depending on the nature of the homework assignments.
 - Critical for the learning process to ensure that students are on the same page and have been able to achieve the learning goals of the previous workshop.
 - Not applicable if this set of slides corresponds to the first submodule of a new module.
-

Before we start: Survey time!

- **Aim:** The pre-submodule survey serves to examine students' prior knowledge about the submodule's topic.
 - Use free survey software such as or other survey software (particify, formR) to establish the following questions (shown on separate slides):
-

What is your level of familiarity with [Topic] (e.g., basic concepts, terminology, or tools)?

- a. I have never heard of it before.
 - b. I have heard of it but have never worked with it.
 - c. I have basic understanding and experience with it.
 - d. I am very familiar and have worked with it extensively.
-

Which of the following concepts or skills do you feel most confident about in relation to [Topic]? (Select all that apply)

- a. Concept 1
 - b. Concept 2
 - c. Concept 3
 - d. Concept 4
 - e. I am not sure about any of these concepts.
-

On a scale of 1 to 5, how comfortable are you with using [specific tool/technology] related to [Topic]? (1 = Not comfortable at all, 5 = Very comfortable)

- a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
-

Discussion of survey results

- **Aim**”: Briefly examine the answers given to each question interactively with the group.
- Use visuals from the survey to highlight specific answers.

Make it clear to the group that there will be a similar post-submodule survey to examine understanding and learning progress.

Where are we at?

- **Aim**: Place the topic of the current submodule within a broader context.
 - Remind students what you are working towards and what the bigger picture is.
-

Learning goals

- **Aim**: Formulate specific, action-oriented goals learning goals which are measurable and observable in line with Bloom’s taxonomy (Anderson et al., 2001; Bloom et al., 1956)
 - Place an emphasis on the **verbs** of the learning goals and choose verbs that align with the skills you want to develop or assess.
 - Examples:
 - Students will **describe** the process of photosynthesis or
 - Students will **construct** a diagram illustrating the process of photosynthesis
-

Key terms and definitions

- **Aim**: Introduce key terms and definitions that students will come across throughout the session.
- **Key Term 1**: Definition
- **Key Term 2**: Definition
- **Key Term 3**: Definition

Base yourself on conceptual change theory and examine existing concepts in relation to some key terms. Re-examine formation of new concepts at the end of the lesson.

Introduction of submodule topic

- **Aim:** Core theoretical introduction of submodule topic.
- Pair theoretical aspects with practical exercises and group discussions according to the Think-Pair-Share style and according to Cognitive Load Theory (Sweller, 1980).
- Use multiple slides for this part.

For a 90-minute lesson, the instructor should try to “lecture” for only 20 minutes, students should work in groups/pairs/on their own for at least 55 minutes of the lesson (+ a 15 minute break).

Submodule content slide

- **Aim:** Present relevant content
- Highlight particularly important aspects with Quarto call-out boxes, for example:

! Important with Title

This is an example of a callout box to highlight particularly important information.

💡 Tip with Title

This is an example of a callout box to give important tips.

Pre-break survey

- **Aim:** This pre-break survey serves to examine students’ current understanding of key concepts of the submodule
-

Use free survey software such as or other survey software (participify, formR) to establish the following questions (shown on separate slides):

Which species is the largest type of penguin?

- a. Chinstrap Penguin
 - b. Emperor Penguin
 - c. Adélie Penguin
 - d. King Penguin
-

What is the key biological feature that helps penguins swim efficiently?

- a. Hollow bones for buoyancy
 - b. Webbed feet for paddling
 - c. Waterproof feathers and flipper-like wings
 - d. Gills to breathe underwater
-

Break! 15 minutes

Post-break survey discussion

- **Aim:** To clarify concepts and aspects that are not yet understood
 - Highlight specific answers given during the survey
-

Practical exercises on topic

- **Aim:** Design practical exercises for students to apply the new skills in practise.
- Depending on the topic, the exercises should be in accordance with the learning objective(s).


For students who advance faster: Prepare extra exercises.

Relevance and implications

- **Aim:** To work out the relevance of the topic to your students.
 - In an interactive setting, discuss how the new skills could be applied in practise with specific examples.
 - Examine downfalls and practical obstacles.
-

Take-home message

Aim: End lesson on clear take-home message that are interactively compiled by students.

 Tip with Title

Add one practical tips or take-home message.

Assignment

- **Aim:** Explain the homework assignment and the rationale behind the homework.
 - Examine whether/how it will be assessed
 - Mention scoring rubrics, if applicable
 - Design a peer-review system for assignments to place students in role of reviewer and author
-

To conclude: Survey time!

- **Aim:** This post-submodule survey serves to examine students' current knowledge about the submodule's topic.
 - Use free survey software such as or other survey software (particify, formR) to establish the following questions (shown on separate slides):
-

What is your level of familiarity with [Topic] (e.g., basic concepts, terminology, or tools)?

- a. I have never heard of it before.
 - b. I have heard of it but have never worked with it.
 - c. I have basic understanding and experience with it.
 - d. I am very familiar and have worked with it extensively.
-

Which of the following concepts or skills do you feel most confident about in relation to [Topic]? (Select all that apply)

- a. Concept 1
 - b. Concept 2
 - c. Concept 3
 - d. Concept 4
 - e. I am not sure about any of these concepts.
-

On a scale of 1 to 5, how comfortable are you with using [specific tool/technology] related to [Topic]? (1 = Not comfortable at all, 5 = Very comfortable)

- a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
-

Discussion of survey results

- **Aim:** Briefly examine the answers given to each question interactively with the group.
 - Compare and highlight specific differences in answers between pre- and post-survey answers
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References

- Provide literature you refer to throughout this lesson.
-

Thanks!

See you next class :)

Pedagogical add-on tools for instructors

- This section is dedicated to ideas on how to incorporate pedagogical tools into teaching for this specific submodule topic. This could mean:
 - Information about the scientific evidence on the theory of the pedagogical add-on tool and the evidence for its efficacy.
 - Discussion/reflection on how tools can be incorporated into the teaching for this particular content.
 - Extra exercises for faster students.
-

Additional literature for instructors

- References for content
 - References for pedagogical add-on tools
 - Other resources (videos etc.)
-

Formatting elements for instructors

- **Aim:** This section contains templates for different formatting elements, which can be modified and adapted for the instructor's individual purposes.
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Text with example links

- [Quarto Documentation](#)
 - [Reveal.js Documentation](#)
 - [Markdown Guide](#)
 - [GitHub](#)
-

Basic text formatting

- **Bold:** `**bold**` → **bold**
 - *Italic:* `*italic*` → *italic*
 - ~~Strikethrough:~~ `~~text~~` → ~~text~~
 - `Inline code: `code`` → `code`
 - `Blockquote: > Quote` →
"This is a quote"
-

Figure with caption

- Centered image and caption below in italics

This is a Penguin.

Figure with bullet points

- First bullet point
 - Second bullet point
 - Third bullet point
-

Side-by-side figures

Stacked figures with text

- First bullet point
 - Second bullet point
 - Third bullet point
-

Two-column text slide

Column 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Vivamus lacinia odio vitae vestibulum vestibulum.
Cras venenatis euismod malesuada.

Column 2

Sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris.

Three-column text slide

Column 1

Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Vivamus lacinia odio vitae vestibulum vestibulum.

Column 2

Sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris.

Column 3

Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla
pariatur.

Simple table

Column 1	Column 2	Column 3
Row 1 Cell	Row 1 Cell	Row 1 Cell
Row 2 Cell	Row 2 Cell	Row 2 Cell
Row 3 Cell	Row 3 Cell	Row 3 Cell
Row 4 Cell	Row 4 Cell	Row 4 Cell

Complex table

Column 1	Column 2	Column 3
Row 1 Cell	Row 1 Cell	Row 1 Cell
Row 2 Cell	Row 2 Cell	Row 2 Cell
Row 3 Cell	Row 3 Cell	Row 3 Cell
Row 4 Cell	Row 4 Cell	Row 4 Cell

Task list

- ☒ Done
- ☐ To do

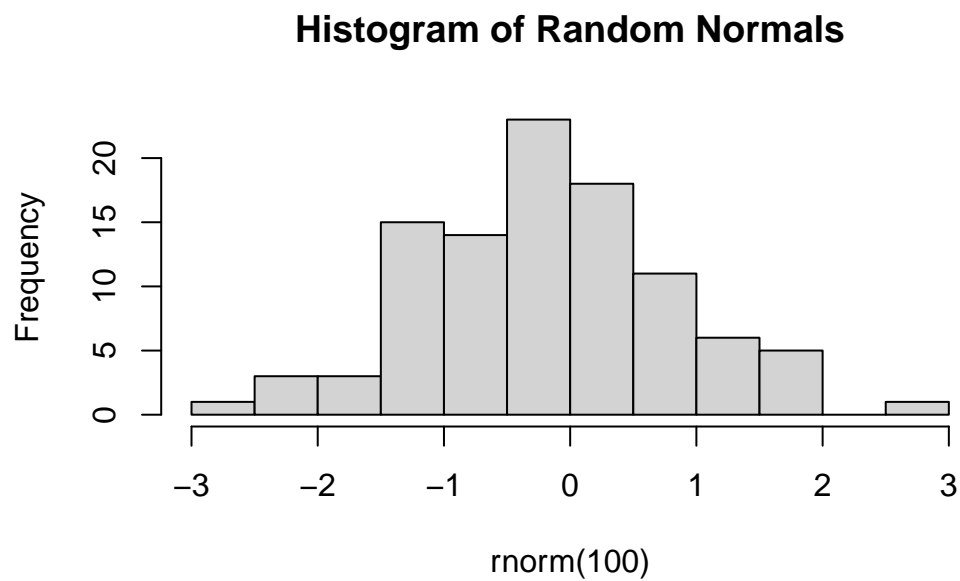
Embedding videos

Code blocks

```
# A basic R code chunk  
x <- 1:10  
mean(x)
```

```
[1] 5.5
```

```
# A simple plot  
hist(rnorm(100), main = "Histogram of Random Normals")
```



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Example attribution (for previous slide)

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