Preregistration

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Credit statement and licence

Possible roles using the CRediT contribition 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 sumodule'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

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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 exisiting 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 (particify, 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

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To conclude: Survey time!

- **Aim**: This post-submodule survey serves to examine students' current knowledge about the sumodule'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

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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.

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

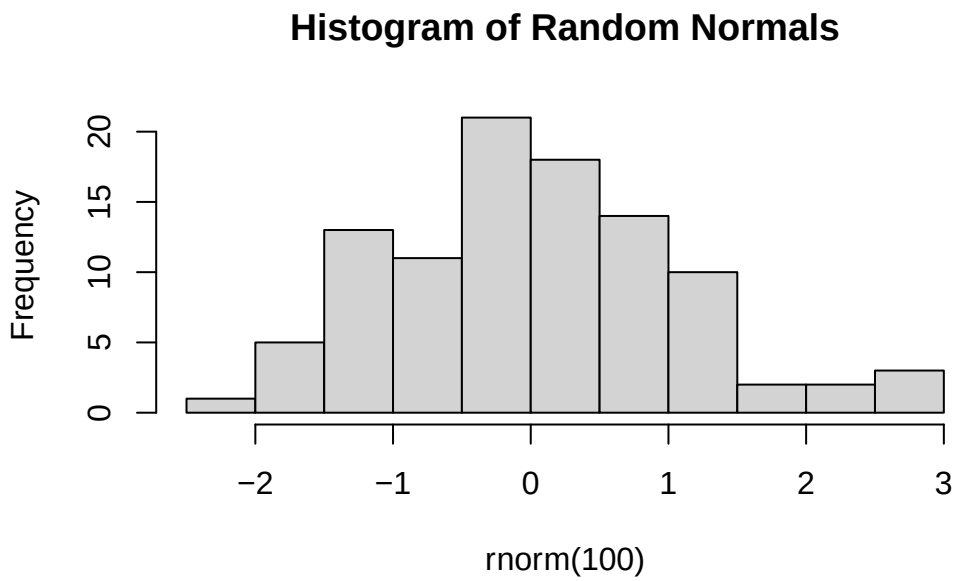
Embedding videos

Code blocks

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

```
[1] 5.5
```

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



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