Applications of R for research

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Contents

Chapter 1

BIOL8700_setup_2022

The goal of BIOL8700_setup_2022 is to setup and generate documents using RStudio, RMarkdown and github

What is special about using `README.Rmd` instead of just `README.md`? You can include R chunks like so:

You'll still need to render `README.Rmd` regularly, to keep `README.md` up-to-date. `devtools::build_readme()` is handy for this. You could also use GitHub Actions to re-render `README.Rmd` every time you push. An example workflow can be found here: https://github.com/r-lib/actions/tree/v1/examples.

1.1 Tools

This is a *sample* book written in **Markdown** and includes embedded R code. This combination of programming languages is included in the RMarkdown package. We use this and a variation of other RMarkdown packages to make the most of reproducible reporting in R.

1.2 Data importing

There are scripts and code included within this repository to import data from csv and excel files from local and online locations.

1.3 Results

You can also embed plots, code and data in an RMarkdown document. The core results of this repository are as follows:

In that case, don't forget to commit and push the resulting figure files, so they display on GitHub.

1.4 RStudio project file

- https://r4ds.had.co.nz/workflow-projects.html

Now that you have been developing a research question over the last few months, the next step is to design a set of experiments that will specifically test your research aims.

We are often focused on the "cookbook" aspect of experiments – the protocols and steps required to conduct each experiment. However, it's critical to spend time designing your overall experimental approach and the finer details to ensure that your research will produce robust data that can be clearly analysed without bias. When we test specific questions, we want to avoid statistical issues such as "noise" and "confounding" factors.

Terry Neeman will be delivering a workshop to help you strengthen your experimental plan – both in terms of your proposed design, and to help you more clearly and accurately explain the rationale and set-up of your experiments. This workshop will help you apply the principles taught in BIOL8291 to your own experiment. To prepare, you will create an outline of your experimental plan, focusing on the statistical framework of your design.

Below is an outline of questions for you to answer/justify for each part of your experimental plan. You will also need to draw two figures (digital drawings preferred) for each aim that show:

1) a simple overview of the experimental plan related to the research aim,
2) a detailed "snap-shot" of the experimental set up (i.e., how will the plates, plants, etc. be arranged? Will there be a row-column design? Blocking? Randomization? What treatments will be applied and how many replicates will be tested?)

You can access the template for the experimental plan on Wattle or a copy can be found within this repository. DOWNLOAD NOW. The template is laid out below as follows:

1.5 Research Question(s)?

```
#input question here
```

1.6 Experimental Aims?

For each experiment explain the overall experimental approach (1-3 sentences + overview diagram) list:

1) the response variables/outcome measure(s) for the experiment
2) the experimental factor(s) of interest
3) the experimental conditions (groups for comparisons), and the number of replicates/sample size for each condition
4) the experimental control(s)
5) are their any potentially confounding factors ("nuisance factors")? Briefly explain how they will be tracked/or mitigated

Briefly explain the design of the experiment and provide a diagram that shows a "snap shot" of the experimental set-up (e.g., how all the plants under different experimental conditions will be arranged, all the plates in the lab, a flow chart of computational steps, etc.). Make sure to consider and include relevant design aspects like blocking, randomisation, as well as to clearly indicate treatments, replicate numbers, and controls.

> TIP: Start thinking about how you will analyse your data:
> "what statistical tests would you use?"

1.7 Importing data

1.8 Visualising data

1.9 Reporting

This week we are going to set up our projects ready for Terry Newmans sample/survey design session next week.

This will involve:

1.10 RMarkdown reports

We shouls all know what these are and how to render a report in RMarkdown. This week we will produce a Rmarkdown report for your question ready to add data and other sampling design using a simple word, html or pdf template.

```
library(rmarkdown)
library(rticles)
library(bookdown)
library(bookdownplus)
```

What does this tell us about how RProjects and other funky things work?

3. Data import

```
library(tidyverse)
#> -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
#> v ggplot2 3.3.5     v purrr   0.3.4
#> v tibble  3.1.6     v dplyr   1.0.8
#> v tidyr   1.2.0     v stringr 1.4.0
#> v readr   2.1.2     v forcats 0.5.1
#> -- Conflicts ------------------------------------------ tidyverse_conflicts() --
#> x dplyr::filter() masks stats::filter()
#> x dplyr::lag()    masks stats::lag()
library(readxl)
```

4. Data visualisation
5. Tidyverse approach
6. ggplot

Tasks ready for next week:

1. Outcome and predictor variables
2. Other studies with same sampling design
3. Other reference material.
4. Read a cool sampling design/issue paper

Watch this short (ish video) as a summary of what you should understand so far.

One aspect that can be challenging when working with RMarkdown documents for manuscripts is references.

The references for a bookdown or rmarkdown file can be included using the following information in the `yml` header of the index file. The references for a bookdown or rmarkdown file can be included using the following information in the yml header of the index file.

1.11 Manual references

1.12 Packages

1.13 Manual references