

“Anxious, excited for the challenge”: A mixed methods time-capsule study across a quantitative research methods and statistics course

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TEACHR

Background

- Psychology students typically enter a degree with high anxiety and low confidence in learning about research methods and statistics (Rode & Ringel., 2019; Tucker et al., 2023).
- Many students reflect that they thought they were not going to be capable, but in hindsight they enjoyed it and did better than they ever expected (Counsell & Cribbie, 2020).
- Anxiety tends to decrease and confidence increases (Rode & Ringel., 2019), and reflections include the positive impact of a teacher in changing their attitudes (Counsell & Cribbie, 2020).

Rationale

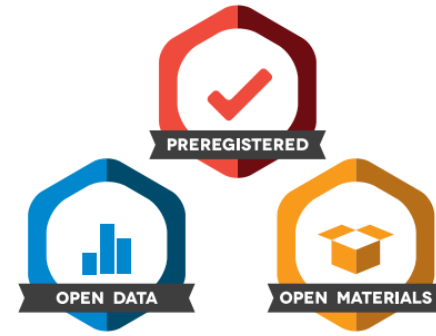
Bringing together three strands of research:

- Reflections typically come half-way (e.g., Miller & Pyper, 2024) or at the end of a course (e.g., Counsell & Cribbie, 2020), not comparing to the start.
- Few studies recruit online distance learning students; MSc conversion offers a unique opportunity to include two modes of study for the same content.
- Studies on perceptions/beliefs of open science (e.g., Beaudry et al., 2022) but not associated with relevant assessments.

Design inspiration:

- Pownall (2023) “Reflections on the Postcard to My Graduating Self Project”.
- Zhang et al. (2014) “The Unexpected Value of Rediscovery”.

Research questions



1. How does confidence/enjoyment in research methods and statistics change across an introductory course within an MSc Psychology Conversion programme?
2. What positive and negative experiences do students report about completing a reproducible research report?
3. What barriers or challenges do psychology students predict they will experience, and how does this compare to the barriers or challenges they actually faced?


Method: Participants

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Full-time face-to-face (F2F)

- 95 enrolled
- 32 completed time 1 (34% recruitment)
- 15 completed time 2 (47% retention) 

Part-time online distance learning (ODL)

- 106 enrolled
- 30 completed time 1 (28% recruitment)
- 9... completed time 2 (30% retention) 

F2F

Time 1:
September
2025

Time 2:
December
2025

ODL

Time 1:
September
2025

Time 2:
June 2026

Method: Measures

Quantitative

- Confidence items: “How confident are you in your statistics abilities?”
- Scales such as VSSL (Alter et al., 2024): “I think the skills I will learn with R/RStudio will be useful outside of class.”
- Importance of reproducible research skills (e.g., “Coding for reproducibility.”)
- Rediscovery (e.g., “How surprised would you be?”)

Qualitative

- Free-text predictions at time 1: E.g., “What barriers do you think you will face learning research methods and statistics?”
- Free-text reflections at time 2: E.g., “What barriers or challenges did you face learning about the course or completing the assessments?”

Method: Time capsule mail merge

Dear participant,

A couple of months ago, you completed a study about your thoughts prior to completing an introductory research methods course. Thank you for taking the time to complete part one of the study. Now that the Research Methods 1 course has finished, we would like you to complete part two of the study to reflect on your experiences completing the course.

You can find the link to part two of the study here: [Research Methods 1 Study Part Two](#).

In part one, you provided the following reflections:

How do you feel about learning research methods and statistics?

«feel_pre»

What barriers do you think you will face learning research methods and statistics?

«barriers_pre»

How do you think you will overcome these barriers to learning research methods and statistics?

«overcome_pre»

What do you think are the benefits to learning research methods and statistics?

«benefits_pre»

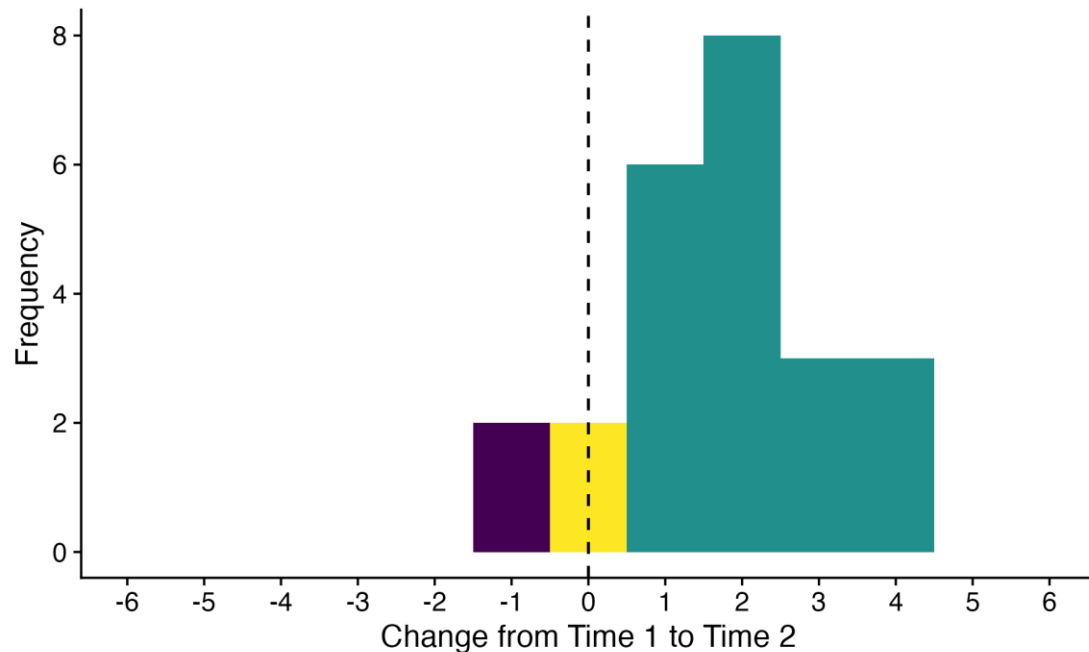
Now that you have completed the course, we would like you to complete part two of the study to look back on these reflections from the start of the course and compare them to how you actually found research methods now you have finished the course.

Quantitative: Confidence and enjoyment

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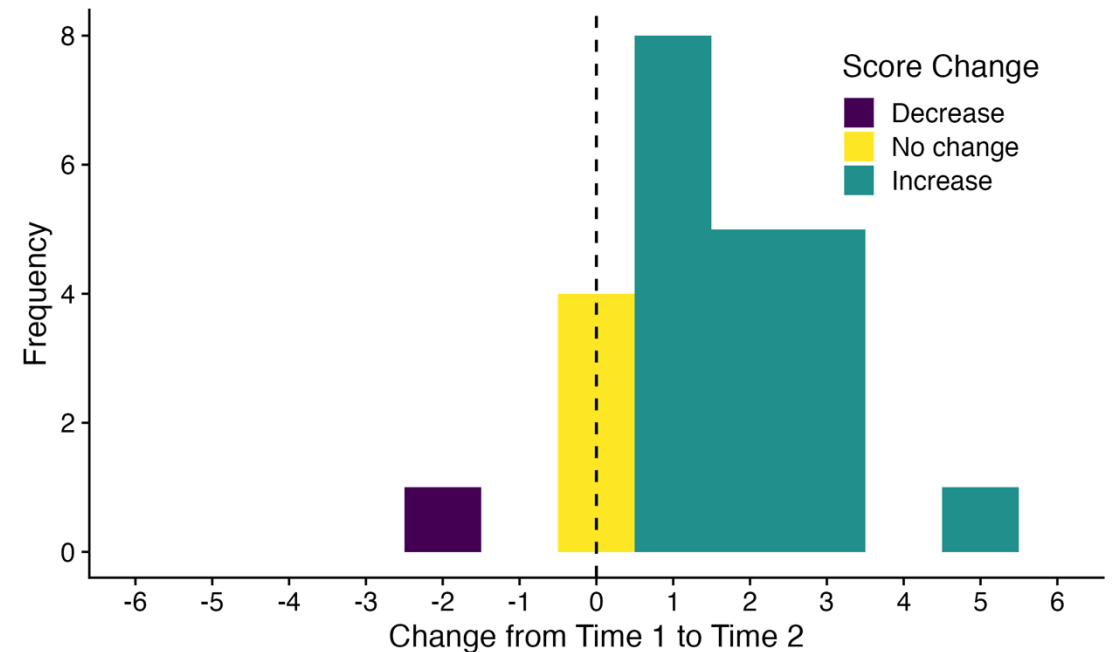
Statistics Confidence

There was a significant increase in statistics confidence,
 $Z = 1.86$, 95% CI = [1.02, 2.7]



Enjoyment using R/RStudio

There was a significant increase in enjoyment using r/rstudio,
 $Z = 1.82$, 95% CI = [0.93, 2.7]



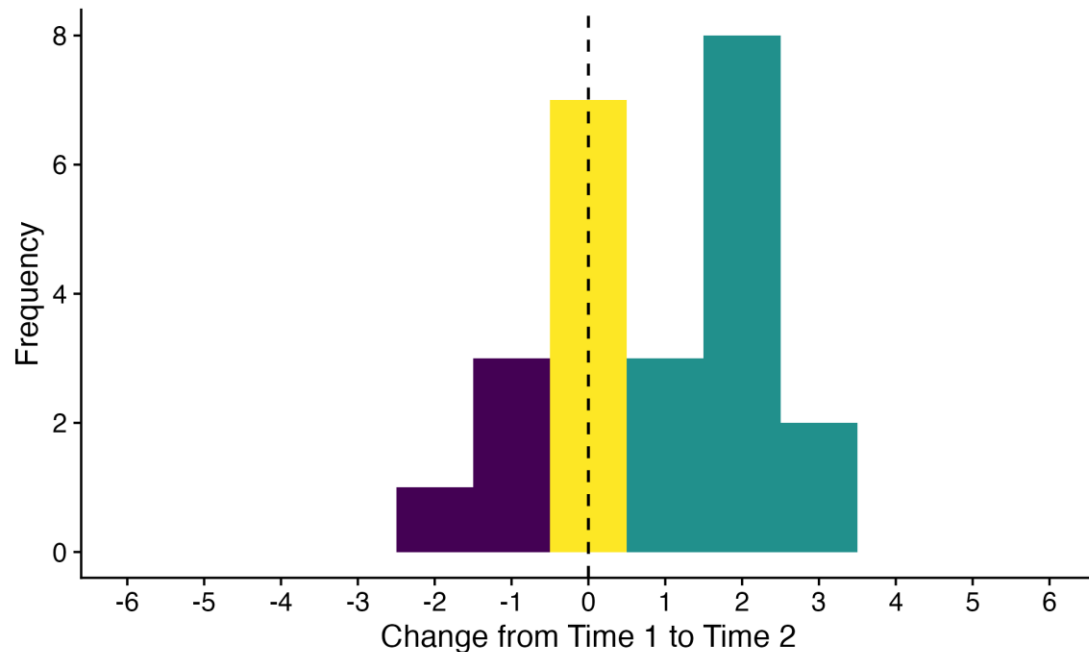
Mixed effects ordinal regression: Standard deviation change from time 1 to time 2; controlling for mode of study.

Quantitative: Reproducible research

PRELIMINARY 

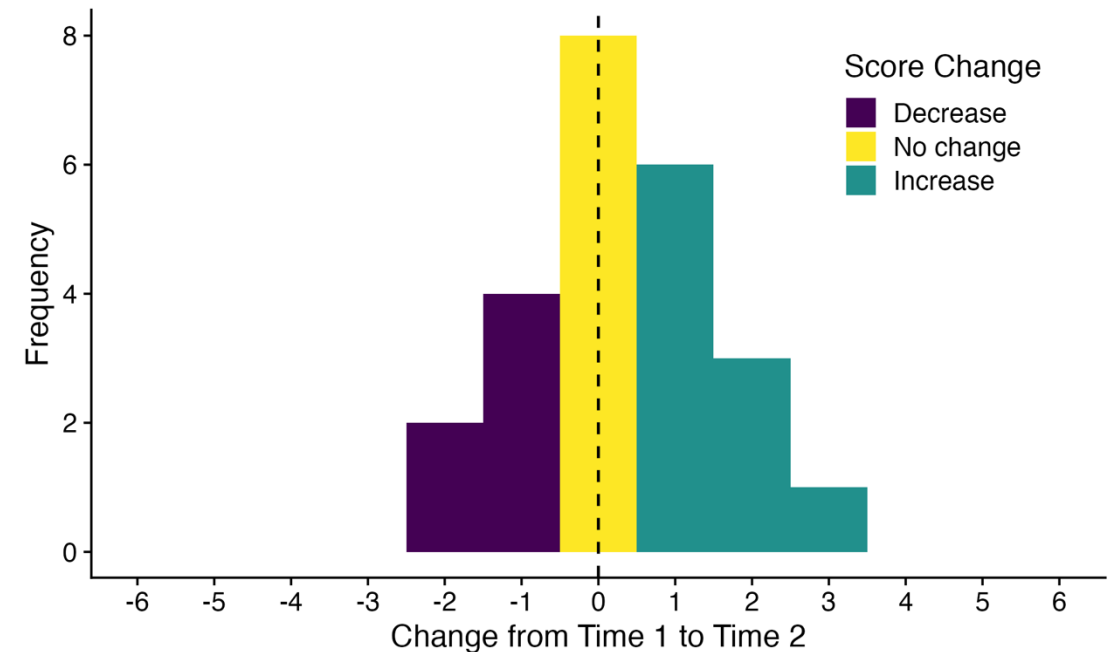
Coding for Reproducibility

There was a significant increase in coding for reproducibility,
 $Z = 0.99$, 95% CI = [0.27, 1.7]



Using Dynamic Documents

There was a non-significant increase in using dynamic documents,
 $Z = 0.41$, 95% CI = [-0.21, 1.03]



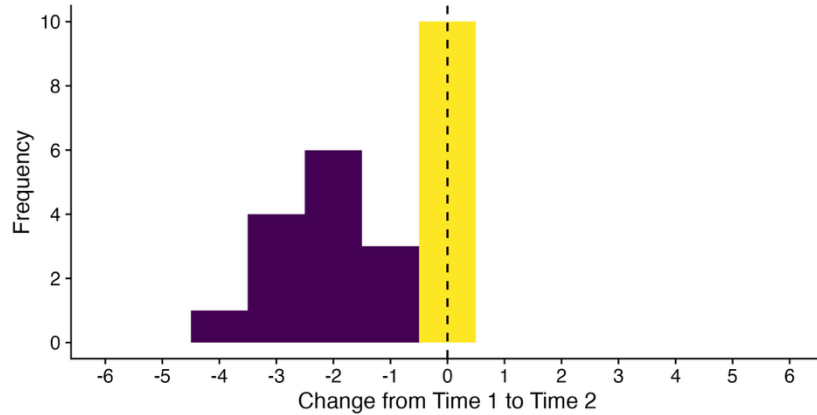
Mixed effects ordinal regression: Standard deviation change from time 1 to time 2; controlling for mode of study.

Quantitative: Rediscovery

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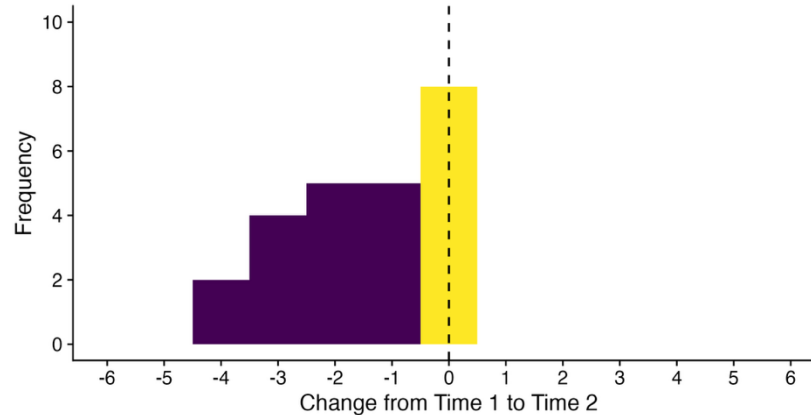
Curiosity in Rediscovery

There was a significant decrease in curiosity in rediscovery, $Z = -1.47$, 95% CI = [-1.87, -1.06]



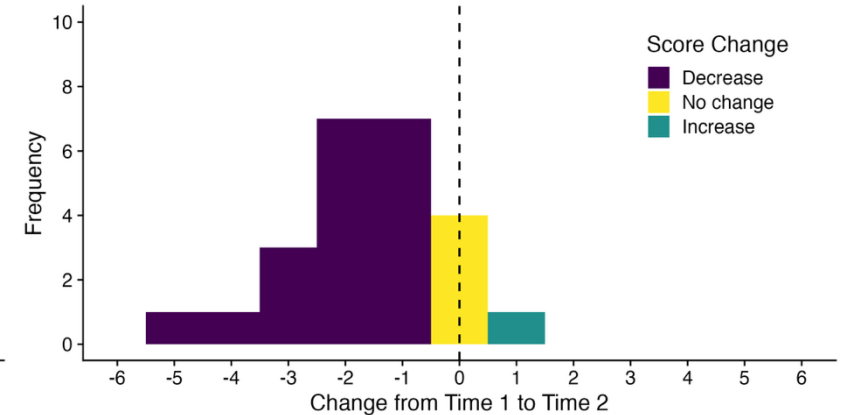
Surprise in Rediscovery

There was a significant decrease in surprise in rediscovery, $Z = -1.47$, 95% CI = [-1.87, -1.06]



Interest in Rediscovery

There was a significant decrease in interest in rediscovery, $Z = -1.47$, 95% CI = [-1.87, -1.06]



Mixed effects ordinal regression across three items: Standard deviation change from time 1 to time 2; controlling for mode of study.

Qualitative: Perceived barriers

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- **Statistics/mathematics:** “I have no experience of coding, and little experience of statistics... I am generally a little anxious when it comes to using numbers”
- **Jargon:** “Remembering all of the terms/equations/values and what they mean”
- **Language/cultural barriers:** “As a non-English speaker, maybe the language will be a challenge because I need to understand some abstract concepts in English”
- **R/RStudio:** “Coding in general as I have never done any coding before”

Qualitative: Actual barriers

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- **Group work:** “Honestly, it was the group assignment that posed quite a challenge when I was trying to finish the group assessment”
- **Workload:** “The volume of the content was at times challenging and I struggled to find the time to go over things I had learnt in previous weeks.”
- **R/RStudio:** “I found R studio incredibly difficult to use as I am not particularly good with computers. But having the course book explaining how to do things in R was extremely helpful as well as the videos.”

Preliminary discussion

- Quantitative and qualitative evidence supports students' (often surprising) confidence and enjoyment in coding, statistics, and research methods (Rode & Ringel, 2019; Counsell & Cribbie, 2020).
- Qualitative data recognised the importance of reproducibility as a norm (Bartlett et al., 2026), while quantitative data more inconclusive about changes in attitudes over the course.
 - Mixed increases in attitudes across a course (e.g., Kang et al., 2026), but students often arrive with high normative expectations (Beaudry et al., 2022).
- Some barriers were consistent across the time points (e.g., statistical jargon, R/RStudio), while group work difficulties was the most prominent unpredicted actual barrier.
 - Groups can provide support and accountability, but critical to properly manage (Vance, 2021), especially in an accelerated, high workload programme.

Limitations

- **Pre-test post-test design**
 - There is no randomisation/counterfactual, so we cannot make any claims about the efficacy of our approach compared to others.
- **Selection bias**
 - Broadly, more motivated students are going to respond and follow-up to a study on research methods and statistics.
- **Free-text survey**
 - Interviews or focus groups would provide greater depth; opportunity for elaboration.

Thank you!

- Data collection will continue until we reach our target sample size of 34-54 participants, possibly extending into the new academic year.
- Pre-print *hopefully* coming soon!
- All questions welcome.



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Course structure

F2F

- 11 weeks in semester 1
- 9 weeks of lectures and labs
- Self-guided R workbook

ODL

- 14 weeks in semester 1 (conceptual knowledge and R)
- 14 weeks in semester 2 (report writing and group work)
- Self-guided R workbook

Assessments

- MCQ
- 2 x Data skills
- Group stage 1 registered report
- Individual reproducible stage 2 registered report

Method: Power analysis

- There are no previous studies with the exact design, but we have explored different studies to see the range of effects: Rode and Ringel (2021) observed pre vs post effects ranging from 0.52 and 1.71. Tucker et al. (2023) observed effects ranging from 0.16 and 0.72. Zhang et al. (2014) observed effects ranging from 0.27 and 0.91. Colaco et al. (2023) reported a different in perceived ability of 0.20.
- For an over-simplified paired samples t-test, we would need between 34 ($d = 0.5$, $\alpha = .05$, $\text{power} = .80$, two-tailed) and 54 participants ($\text{power} = .95$).
- If our final sample size is less than 34, we will rerun the study next year.

Method: Full quantitative materials

1. How confident are you in your statistics abilities? 1 (not at all) – 7 (extremely)
2. How confident are you in your research methods abilities? 1 (not at all) – 7 (extremely)
3. I will enjoy learning R/RStudio as part of this course. 1 (strongly disagree) – 7 (strongly agree)
4. STARS statistics anxiety subscale (8 items). 1 (no anxiety) - 5 (strong anxiety)
5. VSSL (7 items). 1 (never true) – 5 (always true)
6. Importance of reproducible research skills (coding, organisational skills, using dynamic documents). 1 (not very important) – 7 (very important)
7. Reflections (curious, surprised, interested). 1 (not at all) - 7 (extremely)

Method: Full qualitative measures

Time 1

1. How do you feel about learning research methods and statistics?
2. What barriers do you think you will face learning research methods and statistics?
3. How do you think you will overcome these barriers to learning research methods and statistics?
4. What do you think are the benefits to learning research methods and statistics?

Time 2

1. How did you feel about learning research methods and statistics?
2. What barriers or challenges did you face learning about the course or completing the assessments?
3. How did you overcome any barriers or challenges to learning about the course or completing the assessments?
4. What do you know think the benefits are to learning research methods and statistics?
5. What was the biggest surprise in your experience learning research methods and statistics?
6. Imagine you are back in induction week before you started your degree. What would you say to someone starting Research Methods 1 for the first time?

Method: Analysis

- For the single items, we fit mixed effects ordinal regression models to treat time as within-subjects and mode of study as between subjects fixed effects.
- Response ID was a random effect:

$$\text{Rating} \sim \text{Time} + \text{mode_study} + (1|\text{response_id})$$

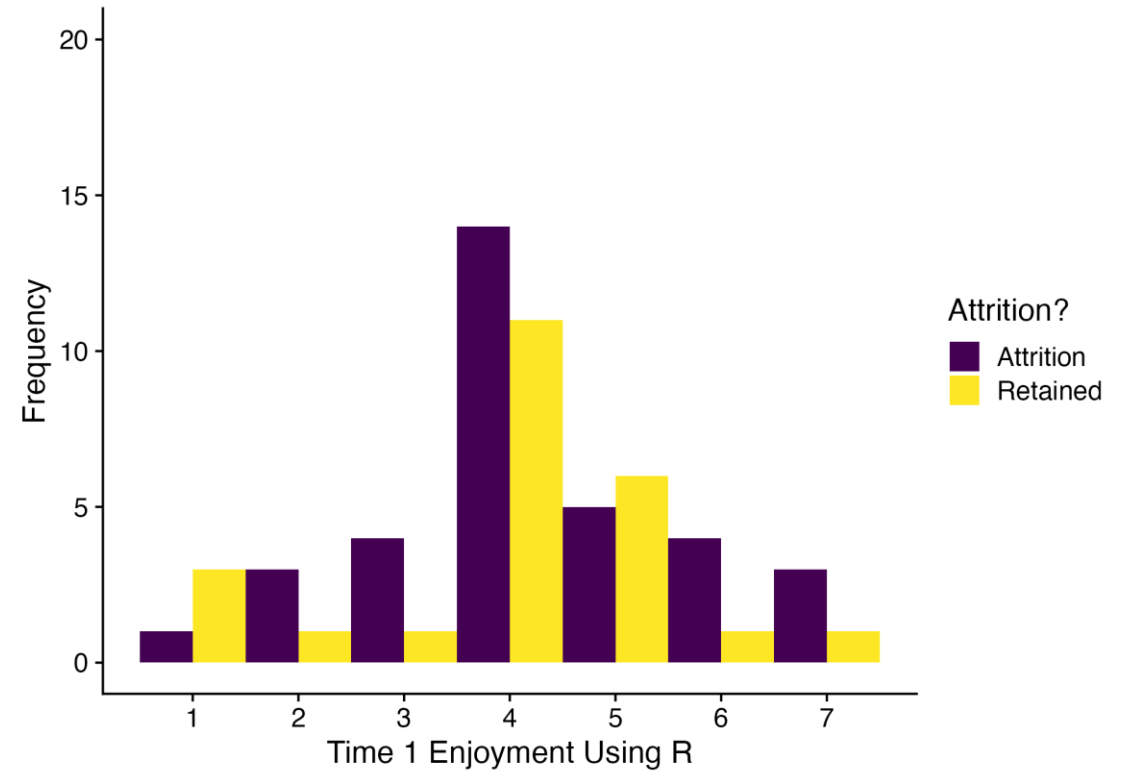
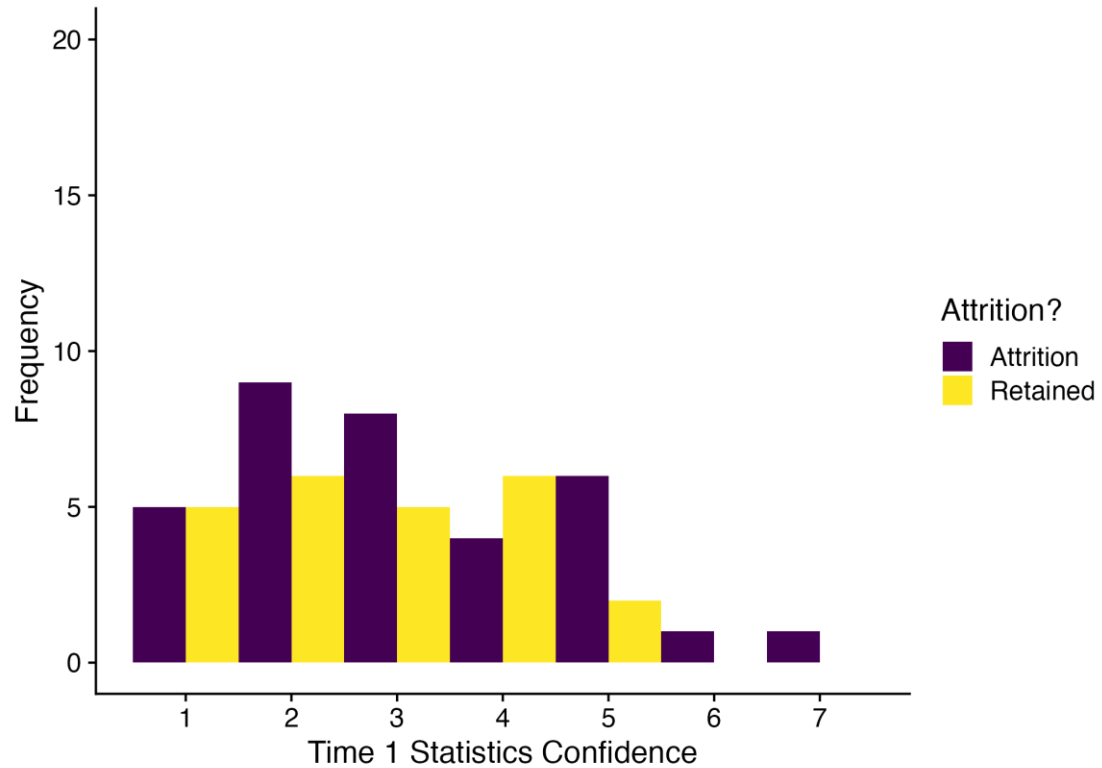
- For scales, we fit the same models, but with the additional random effect of scale items:

$$\text{Rating} \sim \text{Time} + \text{mode_study} + (1|\text{response_id}) + (1|\text{item})$$

- For all models, we used a probit link function to model changes in standard deviations.

Quantitative: Attrition

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Qualitative: Bonus quotes

Learning R/RStudio

- “R studio IS fun to do. Very easy guide to follow and great introduction. I actually like to do R and that is a huge surprise for me”
- “The biggest surprise was realising that I was not terrible at it. That may sound silly, but I genuinely surprised myself, both in terms of how much I enjoyed the subject and how well I was able to engage with it. I was also struck by the number of different ways data can be interpreted and managed”
- “I was a bit surprised how quickly I was able to adapt to the coding aspect of the course, since I thought it'd fly over my head for the first month or so. It was a lot easier and more convenient than what I expected.”

Reproducible research skills

- “I can now understand the extent of how important it is to be able to organize and make your research work reproducible.”
- “It'd definitely be easier to reproduce and organize data in assignments and research using coding, and less time would be spent just tidying data and numbers up compared to having a document open and reading through it manually.”