Example Lab Write-Up

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Introduction

The goal of scientific writing is to convey the results of research to the intended audience in as clear and concise a manner as possible. Without lucid prose and a logical organization of thought, the best work will go unread, meaning that important insights for scientific theory or solutions to real world problems could be lost. The purpose of this brief paper is to highlight some of the most important elements of scientific writing.

In this paper, I will highlight several elements of scientific writing. First, I start the paper with a brief, general introduction to the subject of the paper. The length of the background information varies with your subject, but will usually be just a paragraph or two in lab write-ups. The introduction often provides a brief statement of the purpose or goal of the paper. Second, I follow a logical progression of thought, proceeding from introduction to methods to results and, finally, the discussion or conclusion. It is helpful to keep these sections distinct. Third, I write in active, first-person language (using "I" or "We") and use good grammar. Even the best work will be thrown in the trash unread if it is replete with spelling errors, incomplete sentences, or other errors.

To demonstrate some aspects of a well-written paper, I use data collected from 100 randomly chosen statistics students to assess whether their happiness 5-years after taking the course was related to the scores from their lab write-ups. Specifically, I test the null hypothesis that scores do not affect happiness against the null hypothesis that scores do affect happiness.

Methods

I compiled the scores of 100 randomly chosen students who had taken statistics in 2012 and 2013, and collected data on their overall life happiness five years later. The write-up scores consisted of points from 0 to 100, whereas the happiness scores were recorded from a questionnaire and converted to z-scores. In this paper, I employ simple linear regression to assess the relationship between lifetime happiness and scores on lab write-ups for ENV 710. Before conducting the analysis, I examined the response variable for normality using qq plots. After conducting the analysis, I evaluated the model residuals to verify the test assumptions of normality of residuals and homoscedasticity.

Results

The mean happiness score was 68.92 and the mean write-up score was 51.3. There was no significant difference in mean write-up ($t = 250, df = 98, p = 0.803$) or happiness scores ($t = 0.286, df = 98, p = 0.775$) between genders.

Happiness was positively, and significantly, related to lab write-up score (Fig. 1; $F_{1,98} = 172.7, p < 0.001, R^2 = 0.634$). Write-up scores accounted for 63.4% of the variance in happiness, with happiness increasing by 0.482 for every additional point on the lab write-ups.
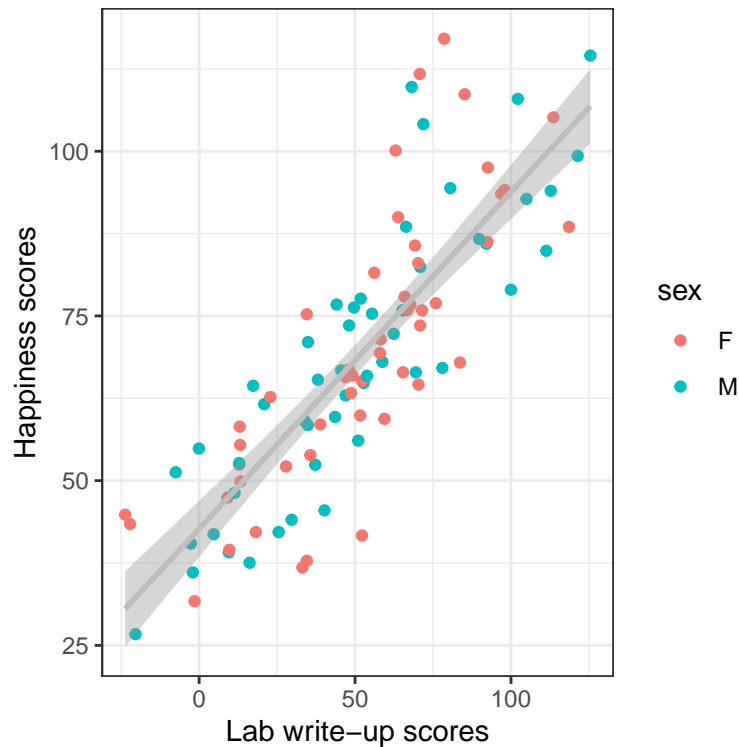
Figure 1: The relationship between lifetime happiness and scores on lab write-ups for 100 randomly selected students.

Discussion

Scores on lab write-ups have extremely strong effects on the happiness of students five years after they completed the course. These stark results demonstrate that paying attention to some basic principals of scientific writing can have remarkable positive effects on students. Some of these basic principles include the following:

- Cite figures or tables in the text - this is evidence that is cited to support your sentence
- Cite statistics appropriately, with the statistic, degrees-of-freedom, and p-value
- Label figures correctly, with good x- and y-axis labels, that include the units, as well as a figure legend, if necessary
- Include a figure description under the figure that describe what the figure demonstrates
- Make sure the text is well-written with appropriate grammar and spelling
- Include all the above components (brief introduction, methods, results, discussion)

Appendix

```
require(ggplot2)

set.seed <- 1001
happy <- rnorm(100, 75, 20)
 set.seed <- 1002
 scores <- seq(1:100) + rnorm(100, 0, 20)
  sex <- rep(c("M", "F"), 50)
```

```r
  hap.dat <- data.frame(cbind(happy = sort(happy), scores = scores))
  hap.dat$sex <- sex

tt1 <- t.test(scores ~ factor(sex), data = hap.dat, var.equal = T)
 tt2 <- t.test(happy ~ factor(sex), data = hap.dat, var.equal = T)

 lm1 <- lm(happy ~ scores, data = hap.dat)
```

```r
gp <- ggplot(hap.dat, aes(x=scores, y = happy)) + geom_point(aes(color = sex)) +
       ylab("Happiness scores") + xlab("Lab write-up scores") +
         geom_smooth(method='lm', color = "grey") +
      theme_bw()
  gp
```