

---

# WARMING UP BODY AND MIND

## INTRODUCTION

Mr. Tyson's former students Natasha and John, both student-athletes, wondered if physical activity was beneficial to academic performance. To test their hypothesis, they randomly assigned 58 volunteers to one of two treatments: sitting at a desk for 60 seconds or running stairs for 60 seconds. After the assigned treatment, each participant took an arithmetic test consisting of 100 questions over 60 seconds.

1. Why were participants randomly assigned to groups before being given their treatments?
2. What null hypothesis did Natasha and John hope to find evidence against?
3. If this null hypothesis was true, what would you expect the difference in the mean number of correct answers to be (*desk* – *stairs*)?
4. The data are shown below along with the means for each group. Compute the difference in the mean number correct (*desk* – *stairs*).

Number correct (desk)				
8	13	16	18	18
19	19	19	22	23
24	25	25	25	27
29	29	30	30	30
31	33	34	34	35
35	36	37	44	44
51				

Mean number correct: 27.839

Number correct (stairs)				
8	11	12	15	18
18	21	22	23	23
25	28	30	32	32
34	36	37	37	37
38	38	39	40	42
53	59			

Mean number correct: 29.926

5. What alternative hypothesis were Natasha and John hoping to find evidence for?
  
  
  
  
  
  
  
  
  
  
6. Recall that the observed difference in the mean number of correct answers (desk – stairs) is  $-2.087$ . Does this value give **some** evidence that exercise is beneficial to academic performance? Explain.

## SIMULATING THE EXPERIMENT

Even if physical activity made no difference in academic performance (the null hypothesis) was true, we wouldn't expect random chance to perfectly balance out the students in the two treatment groups. We would expect them to be close to balanced, though. To determine if the difference in the mean number of correct answers (*desk – stairs*) is more unusual than we might expect due to the chance of the random assignment into groups, let's simulate many different random assignments.

7. Assume that the treatment (*desk* or *stairs*) does not make a difference in the number of correct answers a student will give. How could we use cards to simulate the difference in means (*desk – stairs*) that we would expect to see when subjects are randomly assigned to treatment groups? (We won't be doing this simulation unless time permits.)

8. Use the SPA Applet for One Quantitative Variable at <https://tinyurl.com/SPAapplets> to run a simulation of at least 10000 repetitions. What values for the difference in means (*desk* – *stairs*) seem reasonably typical, just through the random chance process of splitting the subjects into groups? What difference in means values would be really surprising?
  
  
  
  
  
  
  
  
  
  
9. Based on this simulation, what is the (approximate) probability to see a difference in means as low or lower than the one that the researchers observed ( $-2.087$ ), just by the chance of the random assignment process?

## STATISTICAL INFERENCE FROM THE SIMULATION

10. Do Natasha and John have **convincing** evidence against the null hypothesis? Explain.