Yellow vs. White Exams

Math teachers often use two different forms of an exam to prevent students from cheating. One trick teachers use is to give the same exam but on two different colors of paper (white and yellow). Some students believe that yellow is a happier, peaceful color compared to the stark white and that they would tend to score better on yellow paper. To investigate this claim, a teacher gave all of her students the same test and randomly chose half the students to take it on white paper and half the students to take it on yellow paper.

1. If 20 students took an exam, 10 on white paper and 10 on yellow paper, how do you think the average score from students who took the exam on yellow paper would compare to average score of the students who took the exam on white paper? Why?

2. How many different hypotheses could we make for this situation regarding the averages of scores of students who take the exam on yellow paper and on white paper? What are they?

3. a) In statistics, we typically subtract the average scores from two groups in order to compare them. If the color of the exam did not affect students' scores, what would be the most likely outcome (difference in the average scores) when this study is conducted with 20 participants?

   b) Still assuming that the color of the exam did not affect students' scores (i.e. students would get the same score regardless of the color of the exam) what kind of results (difference in the average scores) would you not be surprised to see when this study is conducted with 20 participants?

4. For this experiment, the average test score for the yellow paper was _____ and the average test score for the white paper was _____. Therefore, the actual difference in the average scores of students who took the exam on yellow paper compared to students who took the exam on white paper was _____. If it is REALLY the case that the color of the exam doesn't matter, do you find the teacher's result surprising? Why or why not?

What we want to know is, "How surprising is the observed difference in means under the assumption that the color of the exam did not affect the students' scores on the exam (i.e. the students would have gotten the same score no matter which color paper they received)? This assumption is the **NULL HYPOTHESIS.** To test this we will simulate this situation. Think of how you might use randomness to simulate the way that the 20 students were assigned an exam.

Note, be sure to simulate the teacher's experiment in which randomness determined which color exam a student receives – not the score they got on the exam.

5. As a group, design a simulation assuming the null hypothesis is true. Carry out five trials of the simulation and record your results below. Be sure to get approval from your teacher before carrying out the simulation.

_____ _____ _____ _____ _____

6. a) From your results, does it seem like the results obtained by the teacher would be surprising? Explain.

   b) Combine your results with your classmates. Now does it seem like the results actually obtained by the teacher would be surprising? Explain.

   c) Now, we will use technology to simulate this experiment many, many times under the assumption that the null hypothesis is true. Based on this simulation how surprising are the actual results of this study? Explain your reasoning.

   d) Based on the results of the simulation, how likely is a difference of 6.3 or greater? Explain.

   e) Based on our simulations, what conclusion should the teacher draw? Justify your conclusion.

   f) If the actual study had a difference in means of 10.4 points, then what decision should the researchers make based on this result? Justify your conclusion.