First Name:_____   Last Name:_____

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PSC 041   Research Methods in Psychology   WQ 2023
**Unit 5 Exam Version A**
Research Summary

Adapted from: Hu, D., Ahn, J. N., Vega, M., & Lin-Siegler, X. (2020). Not all scientists are equal: Role aspirants influence role modeling outcomes in STEM. *Basic and Applied Social Psychology, 42*, 192-208.

Are we inspired to follow in the footsteps of a genius or of a hard-worker? Some scientists are portrayed as having an innate brilliance which erupts seemingly effortlessly into scientific discoveries while others are portrayed as diligent hard-workers who struggle with a problem and work long hours in the lab before finally arriving at a discovery. According to a recent study, it may in fact be hard work, not innate genius, that really inspires people to get into STEM.

This study focused on two specific scientists: Einstein, who is generally viewed as a genius whose success came from his talent, and Edison, whose success is typically portrayed to have come from hard work — famously, it took him over one thousand attempts to successfully create the light bulb. Researchers randomly assigned 176 participants to either read a story about either Einstein or Edison, both included details about struggles, challenges and setbacks the scientists had supposedly faced during their career (in fact, the stories for each scientist were exactly the same).

Participants then completed an apparently unconnected math task, designed to investigate their approaches to problem-solving. Participants were given a page of 50 basic addition and subtraction problems (e.g., 65 – 13, 53 + 12) and asked to complete as many as possible within 2 minutes. Performance was indicated by the number of problems that were solved correctly. Since these problems were basic arithmetic calculations, the task did not require much content knowledge and was not very difficult.

Those in the hard work condition (e.g., Edison) (n = 88) performed better, $t(174)$ = 4.32, p = .02, on the mathematical task (M = 37.07, SD = 2.68) than those in the genius (e.g., Einstein) condition (n = 88, M = 33.00, SD = 1.12), suggesting that they'd received a boost in motivation by reading about a scientist known for his work ethic.
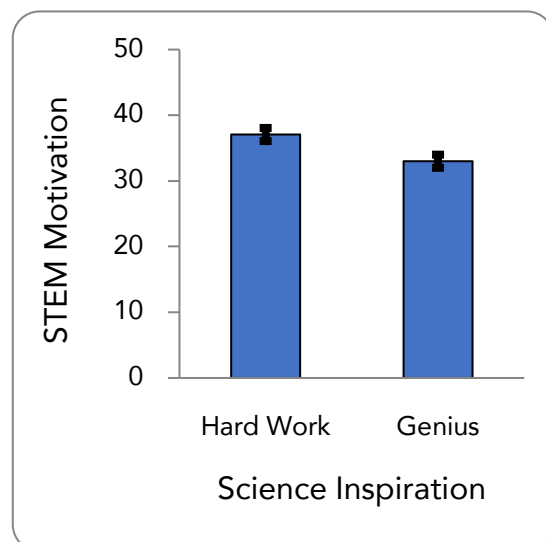
The researchers suggest that being exposed to a stereotypically "genius" scientist makes people feel that brilliance is essential to succeed as a scientist and could reduce a person's interest in science. Whereas exposure to scientists that are successful because of their effort and persistence may motivate people to enter and stay in STEM fields.

Predictor Variable

Thinking about the predictor / independent variable: Role Model Type

10 pts   1. How did the researchers **operationally define** the predictor / independent variable? Describe it using your own words. Be sure to include the levels or values and indicate how the codes will be interpreted.

_____

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1.5 pts 2. The predictor / independent variable is (fill in the box)
- □ **Categorical**
- □ **Continuous**

2 pts   3. How was the predictor / independent variable measured? (fill in the box)
- □ **Observation**
- □ **Physiological**
- □ **Self-Report**
- □ **It was manipulated**

5 pts   4. Is this a causal or associative claim? (fill in the box)
- □ **Causal**
- □ **Associative**

5 pts   5. This variable is (fill in the box)
- □ **between groups**
- □ **within group**

10 pts   6. Evaluate the **construct validity** of the predictor / independent variable.
ProTips: Give an overall evaluation. Think about the face validity, the procedure, and the method-match to inform your decision. Use specific vocabulary. Be sure to only discuss <u>this one variable</u>.

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Outcome Variable

Thinking about the outcome / dependent variable: STEM motivation

Partial operational definition: The number of problems solved correctly on a simple math task within two minutes. Participants could score between 0-50.

1.5 pts 7. The outcome / dependent variable is (fill in the box)
- ☐ **Categorical**
- ☐ **Continuous**

2 pts 8. How was the outcome / dependent variable measured? (fill in the box)
- ☐ **Observation**
- ☐ **Self-Report**
- ☐ **Physiological**
- ☐ **It was manipulated**

Use this only for the next two questions:
Another researcher wants to extend this finding using a different method to measure this variable. All participants took the math exam as described original, but after they took the exam, they were asked to rate their confidence in their math abilities.

2 pts 9. How was this new outcome / dependent variable measured? (fill in the box)
- ☐ **Observation**
- ☐ **Self-Report**
- ☐ **Physiological**
- ☐ **It was manipulated**

10 pts 10. Does the new outcome variable (*Math Confidence*) have stronger or weaker construct validity than the original variable (*Math Performance*) at measuring the <u>construct</u> (**STEM Motivation**)? Explain your reasoning in a few sentences.

_____

_____

_____

10 pts   **11.** For the original research summary, 'different math ability of each participant' is **unlikely to be a confound** because...

_____

_____

_____

_____

10 pts   12. For the original research summary, there is **_not a maturation effect_** because...

_____

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Summarize the findings

5 pts | 13. How did the researchers summarize the findings? (fill in the box)
- ☐ **compare group means**
- ☐ **compare group frequency**
- ☐ **indicate strength and direction of the overall relationship**

5 pts | 14. The error bars _____ overlap. Therefore, there likely ____ a real relationship between the variables? (fill in the box)
- ☐ **do not; is**
- ☐ **do not; is not**
- ☐ **do; is**
- ☐ **do; is not**

5 pts | 15. The *p* value is _____ . Therefore, there ____ a statistically significant relationship between the variables. (fill in the box)
- ☐ **greater than 0.05; is**
- ☐ **greater than 0.05; is not**
- ☐ **less than 0.05; is**
- ☐ **less than 0.05; is not**
- ☐ **greater than 0.5; is**
- ☐ **greater than 0.5; is not**
- ☐ **less than 0.5; is**
- ☐ **less than 0.5; is not**

10 pts | 16. Does this interpretation follow from this study: "Reading about a 'genius' scientist causes people to be less motivated to do math than reading about a 'hard-working' scientist"? Why or why not?

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Evaluate External Validity

10 pts | 17. For this research, the task was reading a short paragraph "about these scientists' struggles and success". Evaluate this aspect of **external validity**.

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10 pts | 18. Another researcher attempted to replicate this study. They recruited another set of participants from the same population and in the same way. They carefully replicated every step of the procedure. They did not find the same results; there was no difference between the two conditions

Can the researchers defend their original findings given this failure to replicate? What logic or reasoning would they use to explain these different results?
ProTip: Clearly state your conclusion (the new findings can be explained in a way that coexists with the original findings <u>or</u> one of the findings is likely invalid) and explain your reasoning in a few sentences. Focus on the difference between internal validity (failure to replicate) and external validity (failure to generalize).

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Multiple Choice

Select the single best answer. Indicate your choice by filling in the box to the left of your selection. Do not make stray marks in the other boxes.

19. According to this graph, what type of relationship do age and distraction share on driving safety?
    ☐ Additive because the lines are parallel
    ☐ Additive because the lines are not parallel
    ☐ Interaction because the lines are parallel
    ☐ Interaction because the lines are not parallel
    ☐ null

Driving Safety by Age and Distraction
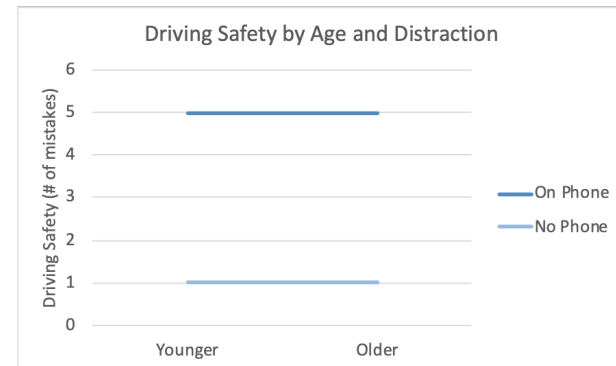
20. Which of these two statements describes the pattern above?
    ☐ The effect of one predictor variable on the outcome variable differs depending on the level of the other predictor variable.
    ☐ The effect of each predictor variable on the outcome variable does not depend on the level of the other

21. This is a ____ design
    ☐ 2x2   ☐ 2x2x2
    ☐ 2x3   ☐ 2x2x3
    ☐ 3x3   ☐ 4x4

22. How many possible main effects could there be in this study?
    ☐ 1   ☐ 3
    ☐ 2   ☐ 4

23. The mean is the most widely used statistic for describing central tendency. However, the mean is heavily influenced by ___.
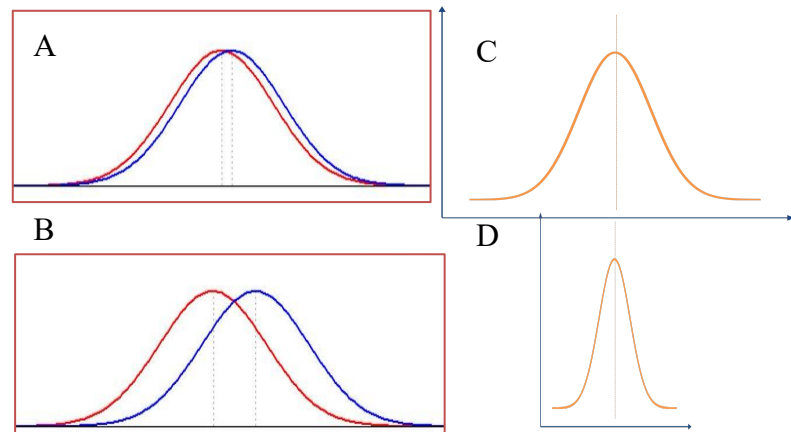   ☐ spread
    ☐ dispersion
    ☐ outliers
    ☐ the median

24. A Cohen's d value of 0.25 can be interpreted as indicating a
    ☐ small effect
    ☐ weak positive correlation
    ☐ strong positive correlation
    ☐ large effect

25. Which of these sketches shows a large effect size?
    ☐ A
    ☐ B
    ☐ C
    ☐ D

26. Qiankun's class takes a personality test in which openness is measured on a scale from 1-7. Based on the distribution of responses from her class, her z-score on openness is 2.7. Which of the following sentences best describes this result?
    ☐ Qiankun is about average for her class on openness.
    ☐ Qiankun is extreme for her class on openness.
    ☐ Qiankun is slightly below average for her class openness.

27. Dr. Johal concludes that their patient does not have Covid-19 but they are wrong. What type of error have they committed?
    ☐ Type II – false negative
    ☐ P-hacking
    ☐ HARKing
    ☐ Type I – false positive
    ☐ File drawer

28. Nikoleta is interested in the relationship between how attractive a defendant is and how guilty they seem. She wants to test the hypothesis that the rating of guilt (measured on a 7-point scale with 1 being "certain innocence" and 7 being "certain guilt") decreases as the rating of attractiveness (measured on a 7-point scale with 1 being "very unattractive" and 7 being "very attractive") increases. The appropriate inferential statistic would be the
    ☐ correlation coefficient r.   ☐ ANOVA.
    ☐ t-test.   ☐ chi-square.

29. Rayna wonders if having a visible tattoo during a job interview is related to being hired or not. The appropriate inferential statistic would be the
    ☐ correlation coefficient r.   ☐ ANOVA.
    ☐ t-test.   ☐ chi-square.

30. Jenny wants to test the hypothesis that the mean amount of sales dollars spent in a month will vary between Oak Ridge, Oak Wood, and Oak Park shopping malls. The appropriate inferential statistic would be the
    ☐ correlation coefficient r.   ☐ ANOVA.
    ☐ z-score.   ☐ chi-square