The effect of preparation on confidence and performance

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Motivation

Our previous research suggests that women prepare more than men, even though they choose to compete less for a multiplication task. However, we were not able to assess whether women are correctly assuming that preparation affects performance, or if they are preparing more than necessary relative the benefits of preparation (i.e., there are opportunity costs to preparing). In conducting our study, we intend to assess whether preparing for a task improves performance.

Overview

We will explore how preparation affects performance by recruiting 800 participants through the student subject pool at the University of Pennsylvania to participate in a timed multiplication task. We are interested in the effect of preparation on 1) participants' performance on the multiplication task, 2) participants' confidence, and 3) participants' beliefs about how completing the task for their assigned condition affected their performance. Before completing the task, they will be randomly assigned to one of two conditions: a preparation condition or a control condition. After participants complete the task, they will answer a series of questionnaires that will be included for exploratory analyses, including beliefs about gender differences in general willingness to prepare and about reasons for gender differences in preparation.

Sampling Plan

Data collection for this project has not yet begun. 800 subjects (or the number of subjects we can recruit until the University of Pennsylvania SONA subject pool closes on December 14th, 2020) will be recruited from the student subject pool at the University of Pennsylvania (SONA) by posting the link to the Qualtrics survey on the SONA site. The listing will read "Participate in a brief study on practice being conducted by researchers at the University of Pennsylvania. Study involves completing questions and completing a short task. Takes approximately 10 minutes. You will earn .25 credits for your participation." Men and women will be evenly assigned to the two conditions. The study will start after approval and will run until all data are collected/the subject pool closes. This is expected to take approximately 2 weeks.

Variables

Manipulated variables

Condition: Participants will be randomly assigned to a preparation condition, where they will be required to practice 50 multiplication problems (randomly selected from the 1-12 times tables), or a control condition, where they will not have this opportunity to practice the multiplication task, completing 50 addition problems instead (randomly selected from the 1-12 addition tables). We are interested in how being provided an opportunity to prepare for a task affects participants' performance and confidence in future performance. While answering questions, participants will

be provided tables of answers (either multiplication or addition) while they are completing the problems for reference throughout.

Measured variables

Gender: Participants' gender will be coded as 1 if they indicate they are female, 0 if they indicate they are male, and 2 if they respond to the question "I identify my gender as: ____ (please specify)".

Subjective confidence: After completing the practice or control task, all participants will be asked to rate "How confident do you feel that you will perform well on the upcoming multiplication task?" on a 0-100 point scale.

Absolute confidence: After completing the multiplication task for their respective condition, all participants will be asked how many multiplication problems they think they solved correctly during the multiplication task. They will enter their response into a text box.

Perceptions of gender differences: After completing the multiplication task, participants will be asked questions about their expectations of gender differences in performance on the multiplication task ("Do you think men or women in this study correctly solved more multiplication problems on average?"), willingness to prepare before completing math tasks ("For math tasks, do you think men or women generally prepare (i.e., practice and/or study) more?"), and general willingness to prepare ("For most tasks, do you think men or women generally prepare (i.e., practice and/or study) more?"), with the options to choose "Men," "Women," or "No difference."

Explanations for previously observed gender differences: Participants will be asked to rank possible explanations for our previously observed gender difference in preparation on the multiplication task, from most likely (1) to explain the gender difference in preparation to least likely (5) to explain it. Responses to this question will be recoded such that the most likely explanation will be coded as 5 and the explanation rated as least likely will be coded as 1. The possible explanations will include:

- Women are more likely to think that practicing will improve their performance on the multiplication task compared to men
- Women enjoy practicing for the multiplication problems more than men
- Women are less confident that they will perform well on the multiplication task compared to men
- Women enjoy the process of mastering their multiplication tables more than men
- Women have more free time to devote to practicing for the multiplication task than men

They will also have the option to list other explanations that they think might explain the previously observed gender difference that were not in the list provided. They will be able to enter their response into a text box.

Performance on the main multiplication task: Participants' performance on the task will be based on the number of problems they answer correctly during the 2 minutes they are allotted.

Interest in the main multiplication task: Participants will indicate the degree to which they "enjoyed completing the multiplication task" on a 1 (strongly disagree) to 7 (strongly agree) scale.

Time spent on addition/multiplication tasks: We will record the total amount of time participants' spend answering questions for preparation condition and control condition, respectively.

Beliefs about the effects of preparation on performance: Participants in the control condition will be asked to indicate how much they agree with the following statement: "I think that if I had the chance to practice the multiplication task by solving 50 practice **MULTIPLICATION** questions before completing this task, it would have boosted my performance," on a 1 (strongly disagree) to 7 (strongly agree) scale.

Study Timeline:

1. Upon entering the study, all participants will first indicate their gender.
2. Participants are randomly assigned to one of the two conditions.
3. Immediately after completing the problems for their respective condition, all participants will be asked to complete the measure of subjective confidence.
4. Participants receive a 30-second break before proceeding onto the multiplication task
5. Participants will complete the multiplication task.
6. Participants will answer the questions about perceptions of gender differences, interest, beliefs about the effects of preparation on performance, subjective confidence, and possible explanations for the previously observed gender difference in preparation.
7. Debriefing: Participants will be told about the purpose of the study and will receive .25 subject pool credits for their participation.

How does preparation affect confidence and performance?

Screening and data exclusion

For the analyses involving gender, we will exclude participants who do not identify as a man or woman. Otherwise, all data will be included in analyses.

Inference Criteria

To control the false-discovery rate during hypothesis testing, we will use the Benjamini-Hochberg correction for the exploratory analyses. We will be using two-tailed tests during all hypothesis testing ($p < .05$).

Hypotheses and analyses

Participants in the preparation condition will have significantly higher ratings of subjective confidence on the main multiplication task compared to participants in the control condition. Also, we expect to see an interaction between gender and condition, such that women's subjective confidence will increase significantly more in the preparation condition. Finally, we expect women will have lower ratings of subjective confidence on average compared to men.

1) Model: Linear regression
a) Predictor(s): Condition, gender, gender*condition

Outcome: Subjective confidence

Exploratory Analyses

Participants in the preparation condition will have significantly higher performance on the main multiplication task compared to participants in the control condition. We have no a priori predictions regarding the effect of gender nor the interaction between gender and condition on performance.

1) Model: Linear regression
a) Predictor(s): Condition, gender, gender*condition
b) Outcome: Performance on the main multiplication task

We have no a priori predictions regarding the effect of condition, gender, nor the interaction between gender and condition on absolute confidence.

2) Model: Linear regression
a) Predictor(s): Condition, gender, gender*condition
b) Outcome: Absolute confidence

We have no a priori predictions regarding the effect of gender on interest in the multiplication task.

3) Model: T-test
a) Predictor(s): Gender
b) Outcome: Interest in the main multiplication task

For Model 1, participants will be significantly more likely to believe that there are no gender differences in performance on the multiplication task compared to the other two options. For Models 2 and 3, participants will expect women to prepare more than men both before math tasks and in general.

4) Model 1: Chi-square goodness of fit test (collapsed across conditions) with perceptions of gender differences in performance on the main multiplication task as variable
5) Model 2: Chi-square goodness of fit test (collapsed across conditions) with perceptions of gender differences in willingness to prepare before completing math tasks as variable

6) Model 3: Chi-square goodness of fit test (collapsed across conditions) with perceptions of gender differences in general willingness to prepare as variable

a) Note: If the cells counts for any of these models is less than 5, we will run Fisher's exact test instead of Chi-square goodness of fit.

We have no a priori predictions regarding the effect of gender on performance on the main multiplication task.

7) Model: T-test

a) Predictor(s): Gender

b) Outcome: Performance on the main multiplication task

We have no a priori predictions regarding the effect of condition on absolute confidence.

8) Model: T-test

a) Predictor(s): Condition

b) Mediator: Absolute Confidence

Participants in the preparation condition will have significantly higher ratings of subjective confidence on the main multiplication task compared to participants in the control condition, which will in turn be positively related to performance on the task.

9) Model: Mediation

a) Predictor(s): Condition

b) Mediator: Subjective Confidence

c) Outcome: Performance on main multiplication task

We have no a priori predictions regarding the effect of condition on time spent on the addition/multiplication tasks.

10) Model: T-test

a) Predictor(s): Condition

b) Outcome: Time spent on addition/multiplication tasks for preparation/control condition, respectively

We have no a priori predictions regarding the effect of gender on beliefs about the effects of preparation on performance.

11) Model: T-test

a) Predictor(s): Gender

Outcome: Beliefs about the effects of preparation on performance

Note: this analysis will only include participants from the control condition

We have no a priori predictions regarding whether participants will be significantly more likely to select one explanation compared to others.

12) Model: Test of uniformity (collapsed across conditions) with explanations for previously observed gender differences as variable