College of Arts & Letters
MICHIGAN STATE UNIVERSITY

The extent to which the use of ChatGPT influences student knowledge retention rates from an in-class assignment.

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Research Questions

- To what extent does the use of ChatGPT in an upper-division Social Science Data Analytics Applications course influence student knowledge retention rates from an in-class assignment?

- Can ChatGPT potentially replace peer cooperative learning in identifying errors in code?

TAR Objectives

- Characterize current student usage of ChatGPT in an upper-division Social Science Data Analytics Applications course.
- Examine student usage of ChatGPT to determine whether the in-class activity spurred any additional usage.
- Compare student knowledge retention rates from an in-class assignment with and without the use of ChatGPT.
- Characterize if ChatGPT, when used as a learning tool, can act as a substitute for cooperative/peer learning.

Cooperative Learning Objectives

1. **Positive Interdependence:** Students must believe that they are linked with others in a way that one cannot succeed unless the other members of the group succeed (and vice versa).

2. **Face-to-Face Promotive Interaction**

3. **Individual Accountability/Personal Responsibility**

4. **Teamwork Skills**

5. **Group Processing:** Professors need to ensure that members of each cooperative learning group discuss how well they are achieving their goals and maintaining effective working relationships.

Context for Present Study

- This in-class intervention was aimed at all undergraduate students enrolled in Spring 2024's upper-division Social Science Data Analytics Applications Course, taught by Professor Ben Bushong.
- The class is structured with three distinct bits.
- Students did all of their analyses with the open source (and free) programming language R.
- For the purposes of learning R coding, students are permitted to use ChatGPT, or other generative AI models, *provided* they indicate such a use at the top of their problem sets.

Intervention Timeline

Participants were randomly split into two groups.

Group 1 participants were asked to use ChatGPT as a learning tool while completing an activity.

Group 2 was asked *not* to use ChatGPT, but instead utilize fellow Group 2 members to complete the activity.

Students were asked to complete the activity and take a short survey.

A week later I went back and asked the participants who attended class that day to repeat the survey and respond to the questions based solely on memory.

R Code with Intentional Errors

Please input the following codes in your RStudio command line, hit "Enter", and inspect what the error is and why you are getting it. Then, re-input the code with all the necessary fixes and repeat that process till you no longer get back an error message. **Please keep a note of what the fix was as you will need it for the survey.**

 # Error 1:

```
message <- "Welcome to the R coding challenge"
print(messages)
```

Note to self:

 # Error 2:

```
print("Hello, World!"
```

Note to self:

 # Error 3:

```
grp <- c("Group 1", "Group 2)
```

Note to self:

 # Error 4:

```
x <- 5
y <- 10

result <- x * y + 2
print("The result is: " result)
```

Note to self:

#Error 5:

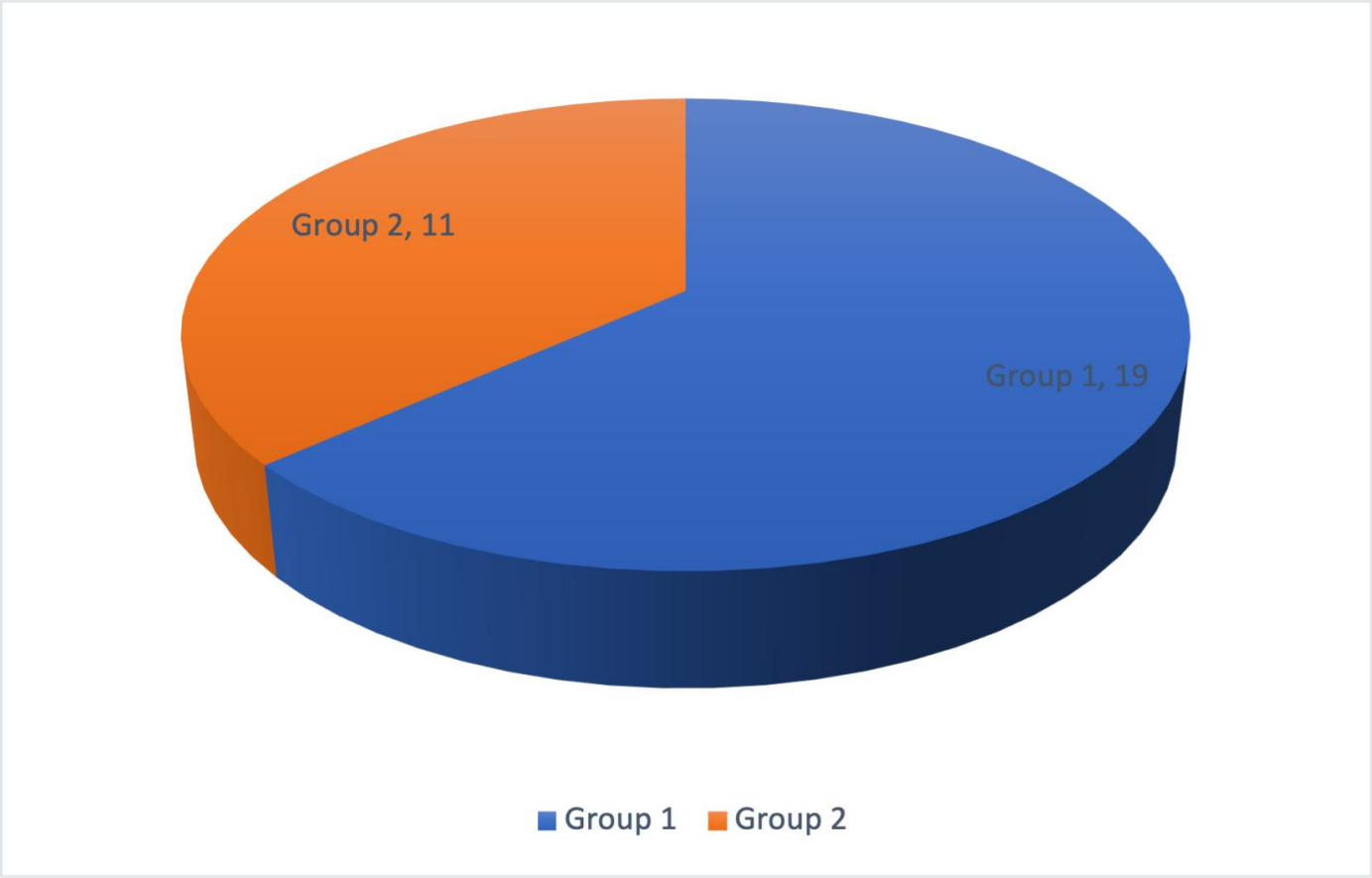
```
numbers <- c(1, 2, 3, 4, 5)
print(numbers[6])
```

Survey consisted of 6 questions.

- Q1: Age
- Q2: Group Assignment
- Q3: ChatGPT Usage
- Q4: Logical Coding Error
- Q5: Indexing Coding Error
- Q6: Name

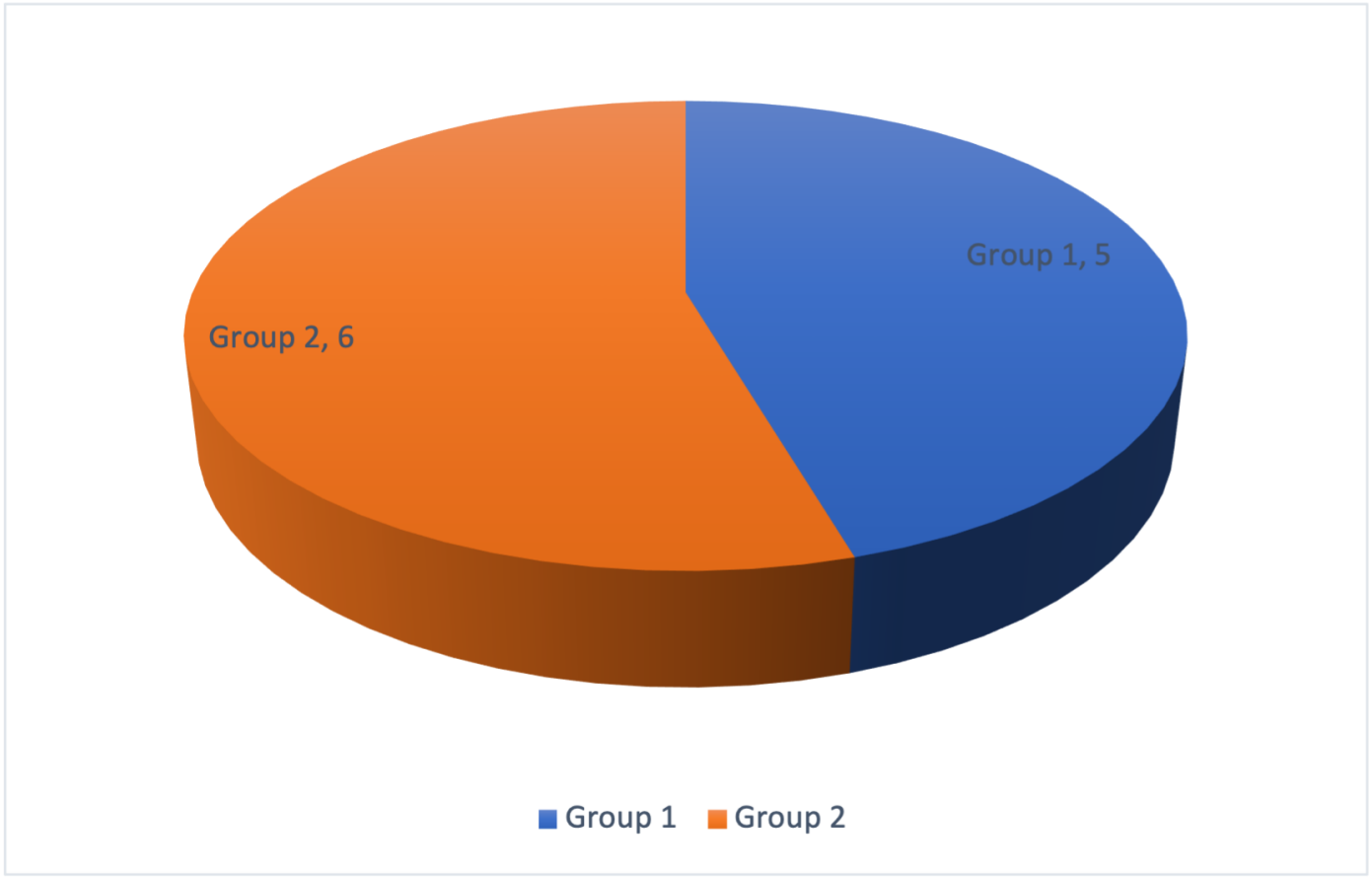
Initial Survey Group Assignment Pie Chart

Q2-Were you assigned to Group 1 or Group 2?



Follow-Up Survey Group Assignment Pie Chart

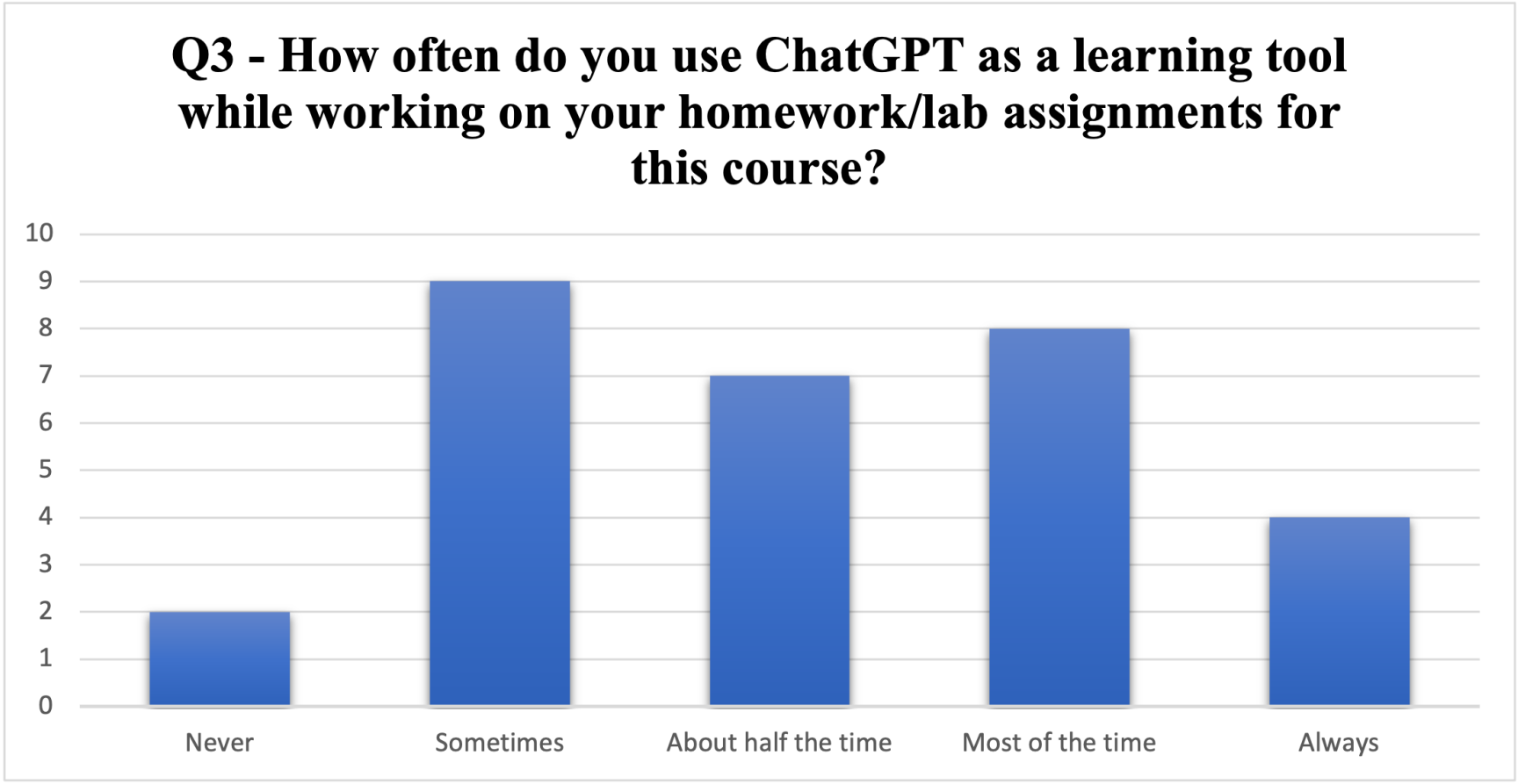
Q2-Were you assigned to Group 1 or Group 2?



Methodology for In-Class Intervention

- **<u>Objective #1:</u> Characterize current student usage of ChatGPT in an upper-division Social Science Data Analytics Applications course.**

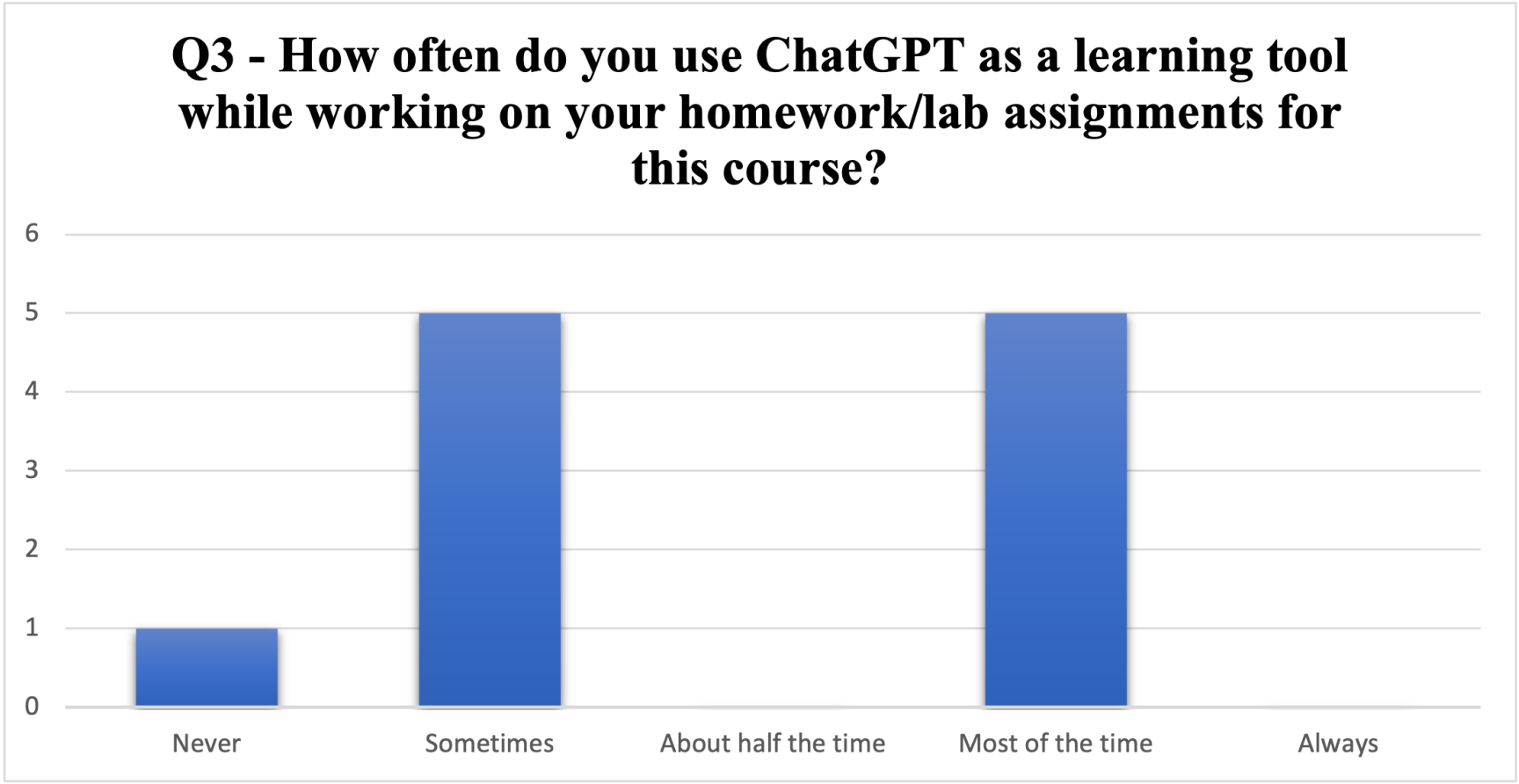
Initial Survey ChatGPT Usage Bar Graph



Methodology cont'd

- **<u>Objective #2:</u> Examine student usage of ChatGPT to determine whether the in-class activity spurred any additional usage.**

Follow-Up Survey ChatGPT Usage Bar Graph



How did usage (if at all) change within respondents?

- Overall, the repeat survey responders answered identically, with the exception of two students who switched up their answers.

- Specifically, one went from “Always” to “Most of the time”, and the other went from “About half the time” to “Most of the time”, signaling a decline and an increase in student usage, respectively.

Methodology cont'd

- **<u>Objective #3:</u> Compare student knowledge retention rates from in-class assignments with and without the use of Generative AI.**

- **<u>Objective #4:</u> Characterize if ChatGPT, when used as a learning tool, can act as a substitute for cooperative/peer learning.**

Question 4

Q4

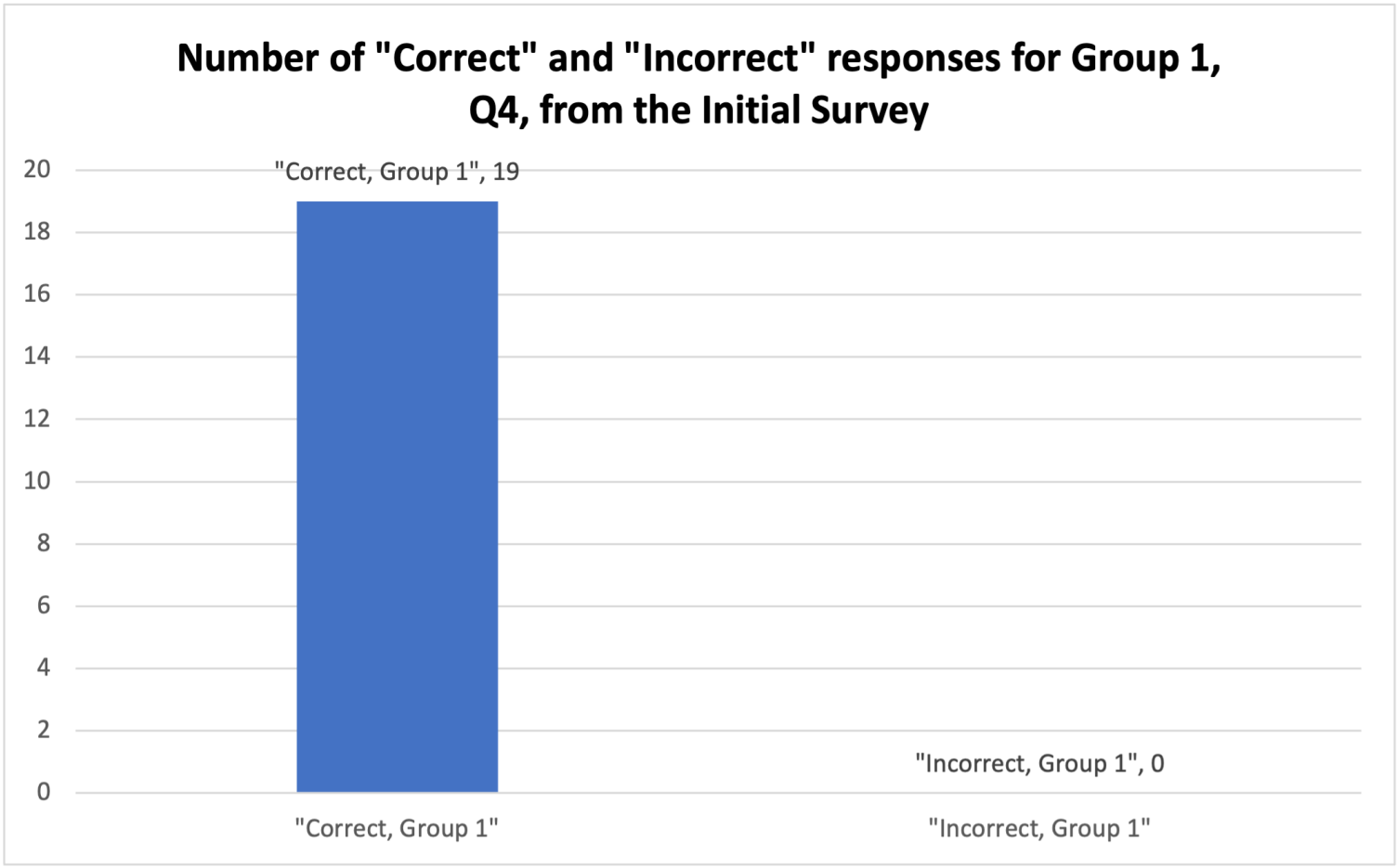
Please write what the correct version of the following code (not its output) would look like:

```
x <- 5
y <- 10

result <- x * y + 2
print("The result is: " result)
```

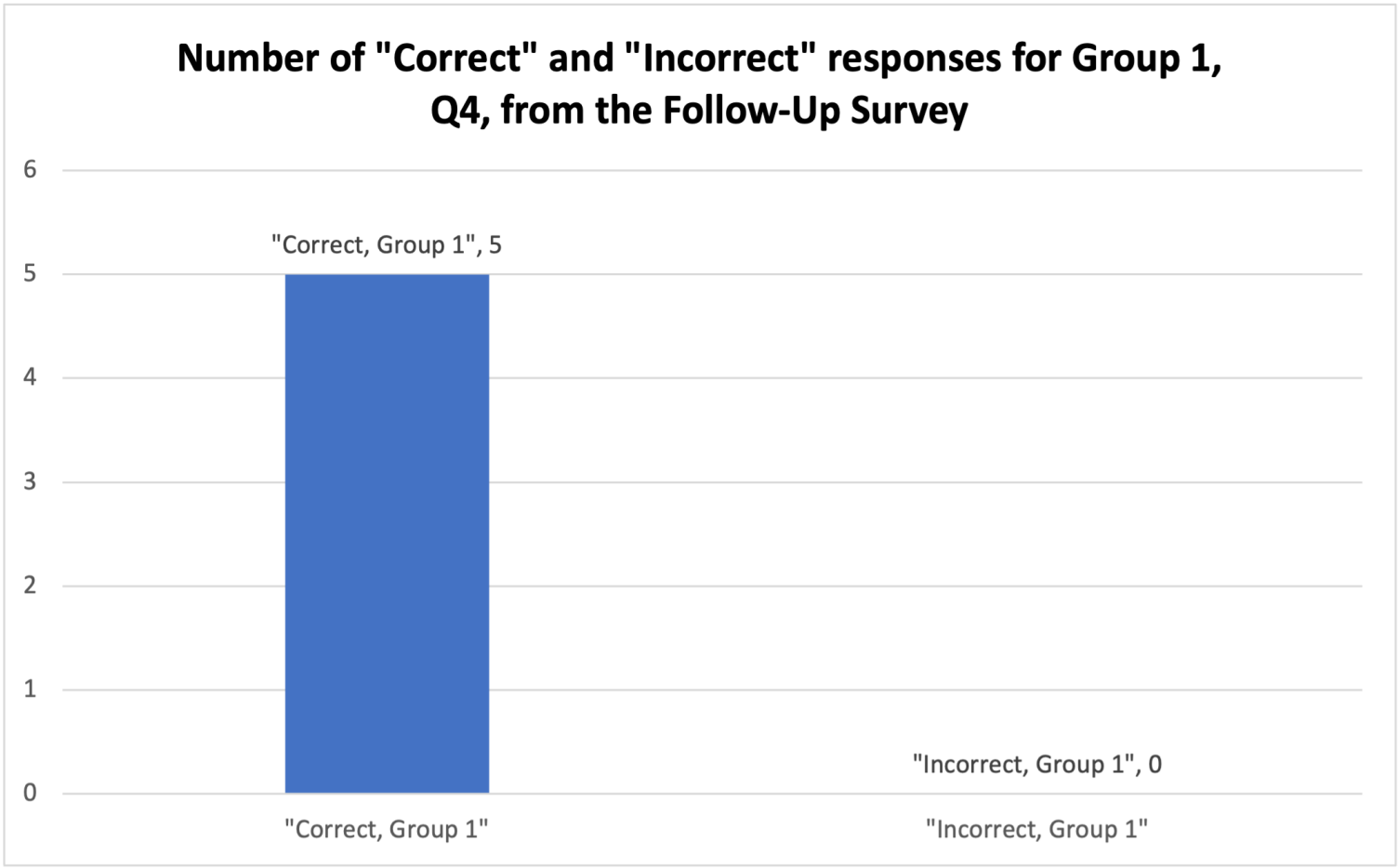
Bar Graph of Group 1, Q4, Responses

Initial Survey



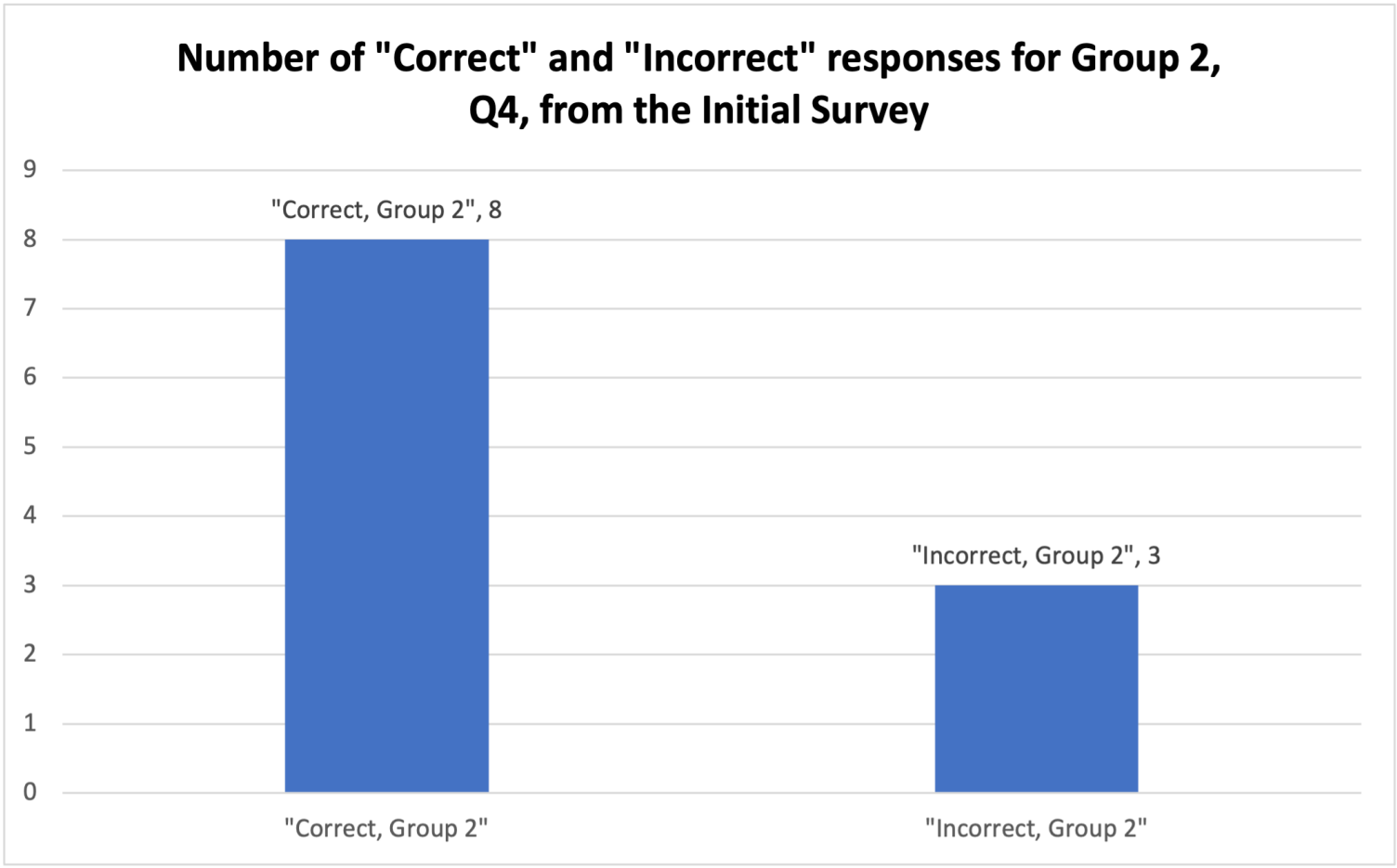
Bar Graph of Group 1, Q4, Responses

Follow-Up Survey



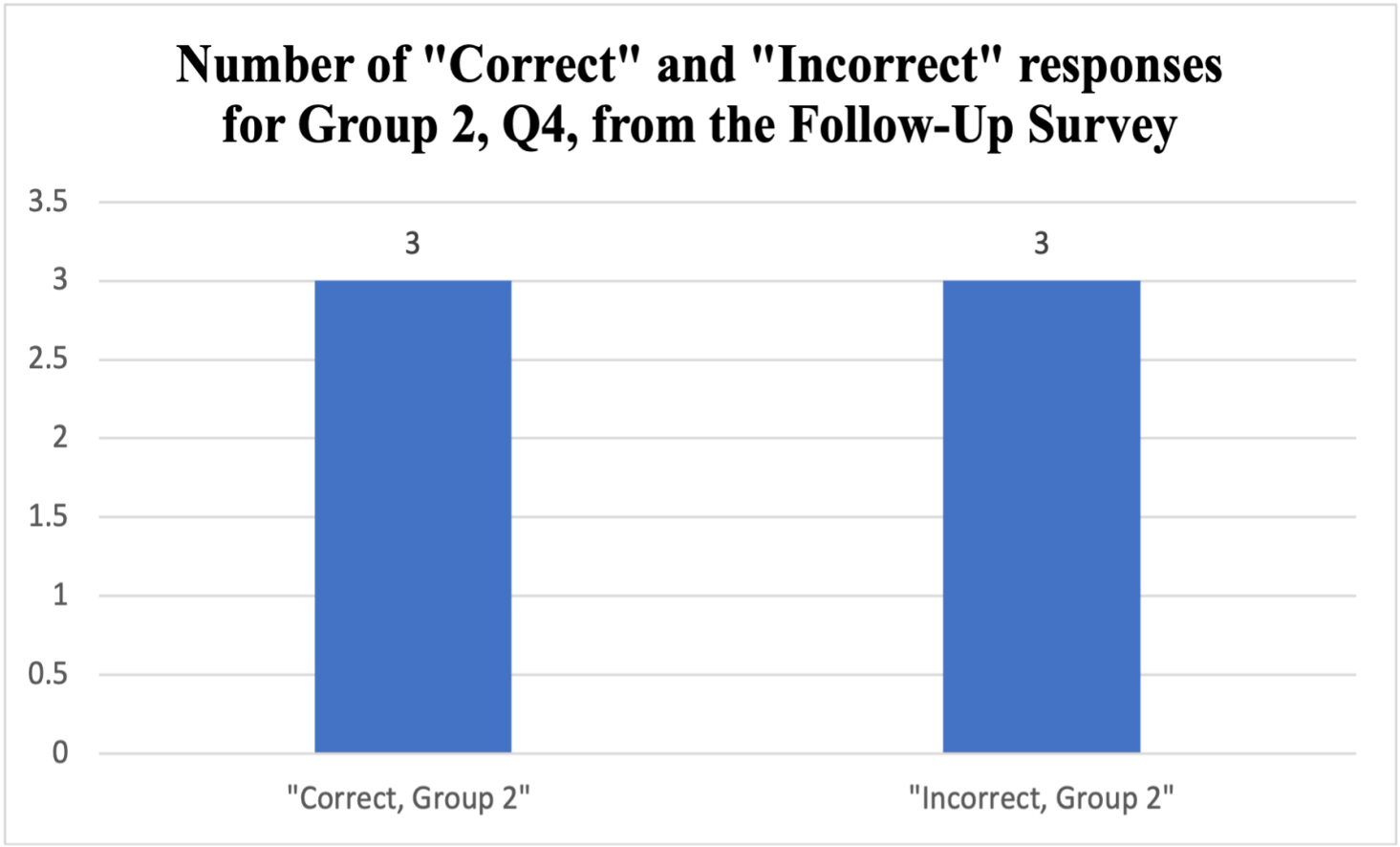
Bar Graph of Group 2, Q4, Responses

Initial Survey



Bar Graph of Group 2, Q4, Responses

Follow-Up Survey



Question 5

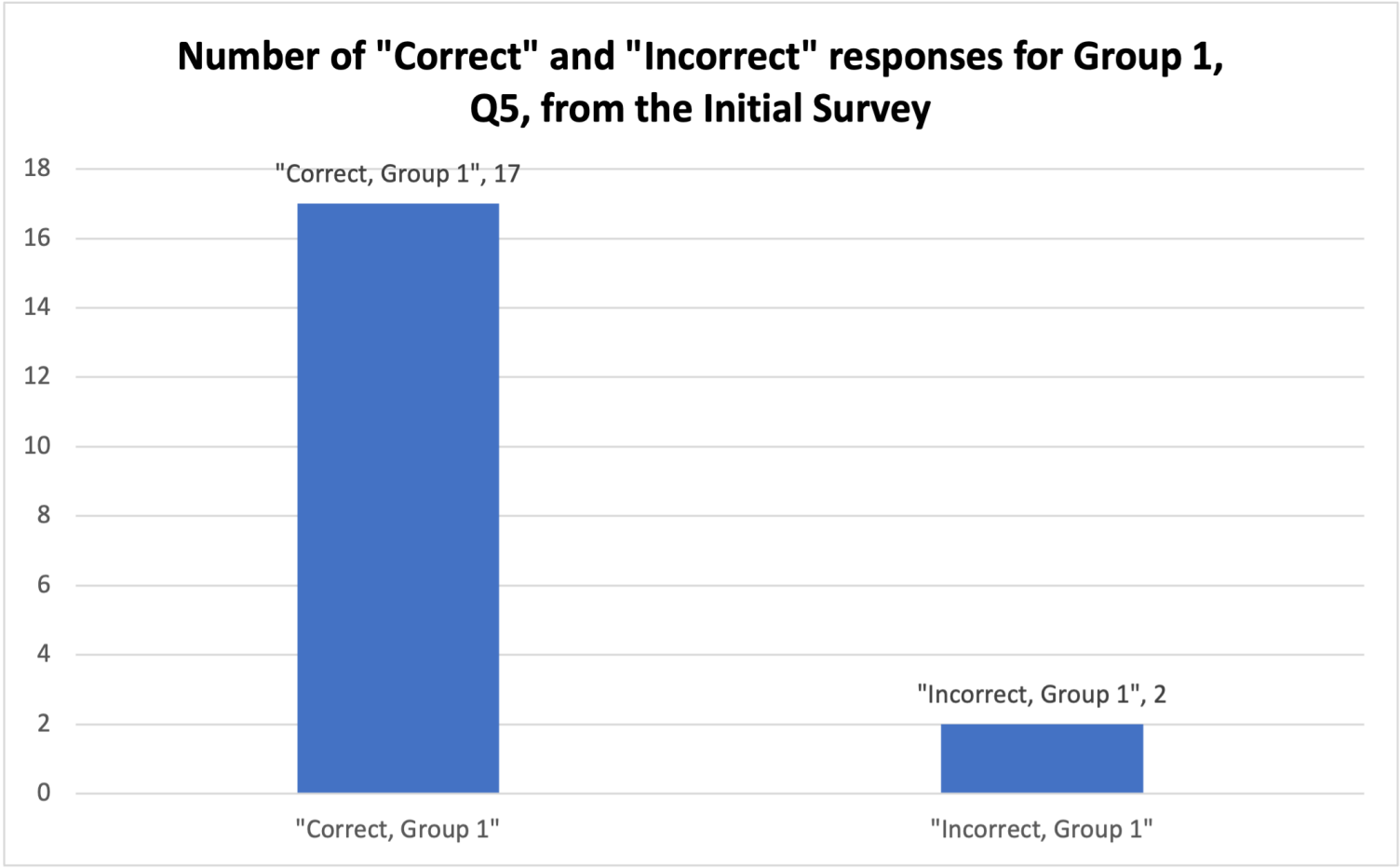
Q5

Please write what the correct version of the following code (not its output) would look like:

```
numbers <- c(1, 2, 3, 4, 5)
print(numbers[6])
```

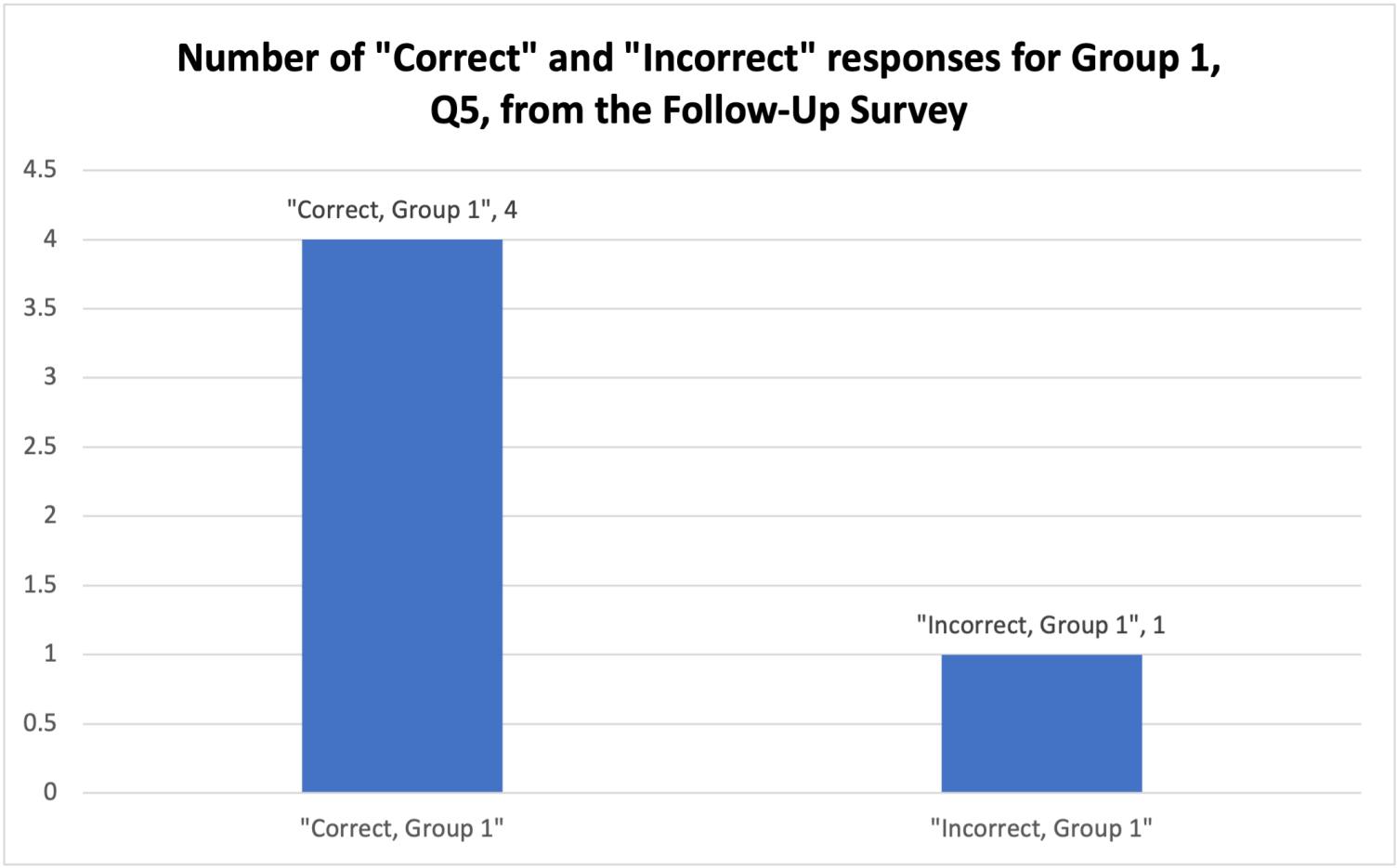
Bar Graph of Group 1, Q5, Responses

Initial Survey



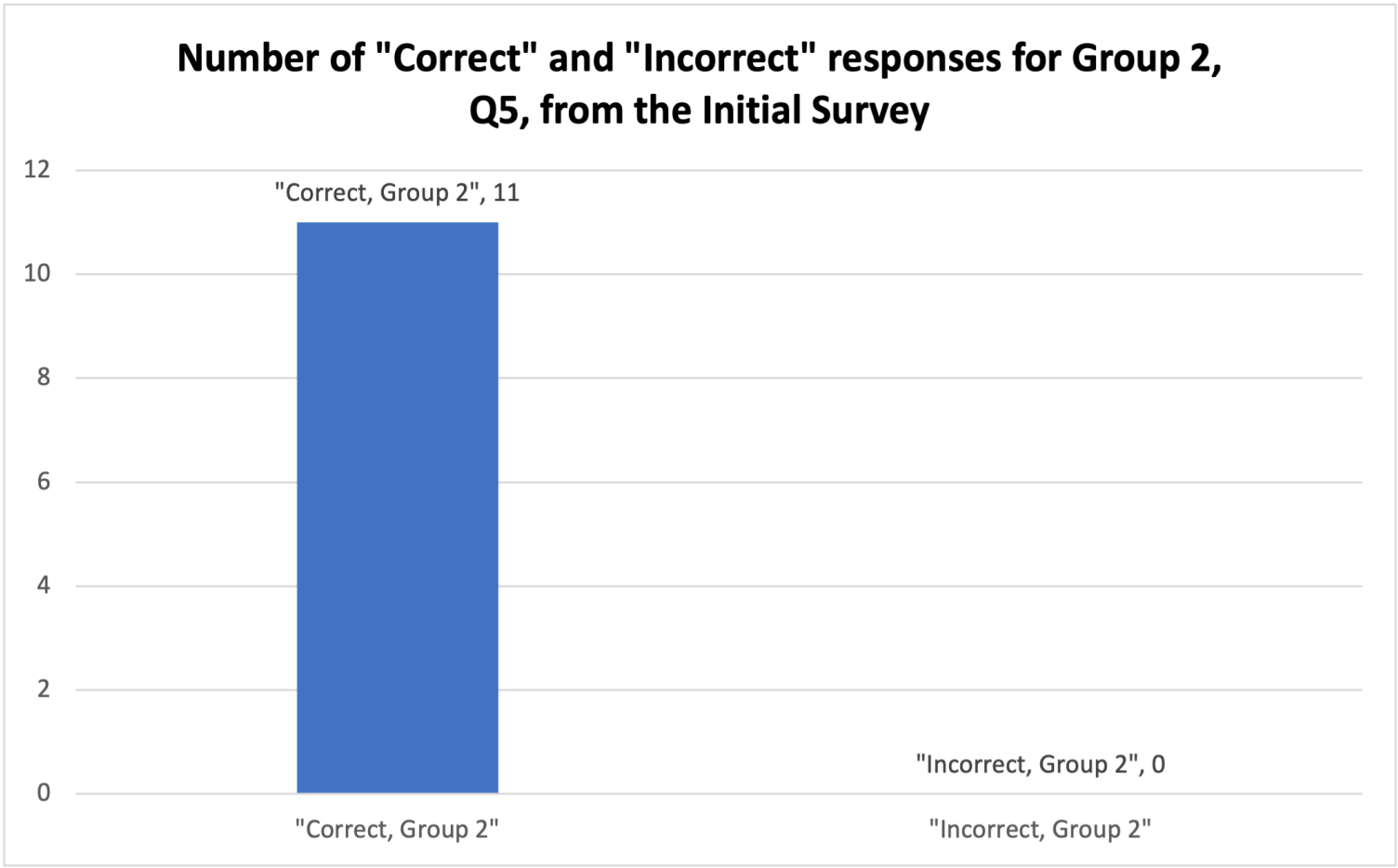
Bar Graph of Group 1, Q5, Responses

Follow-Up Survey



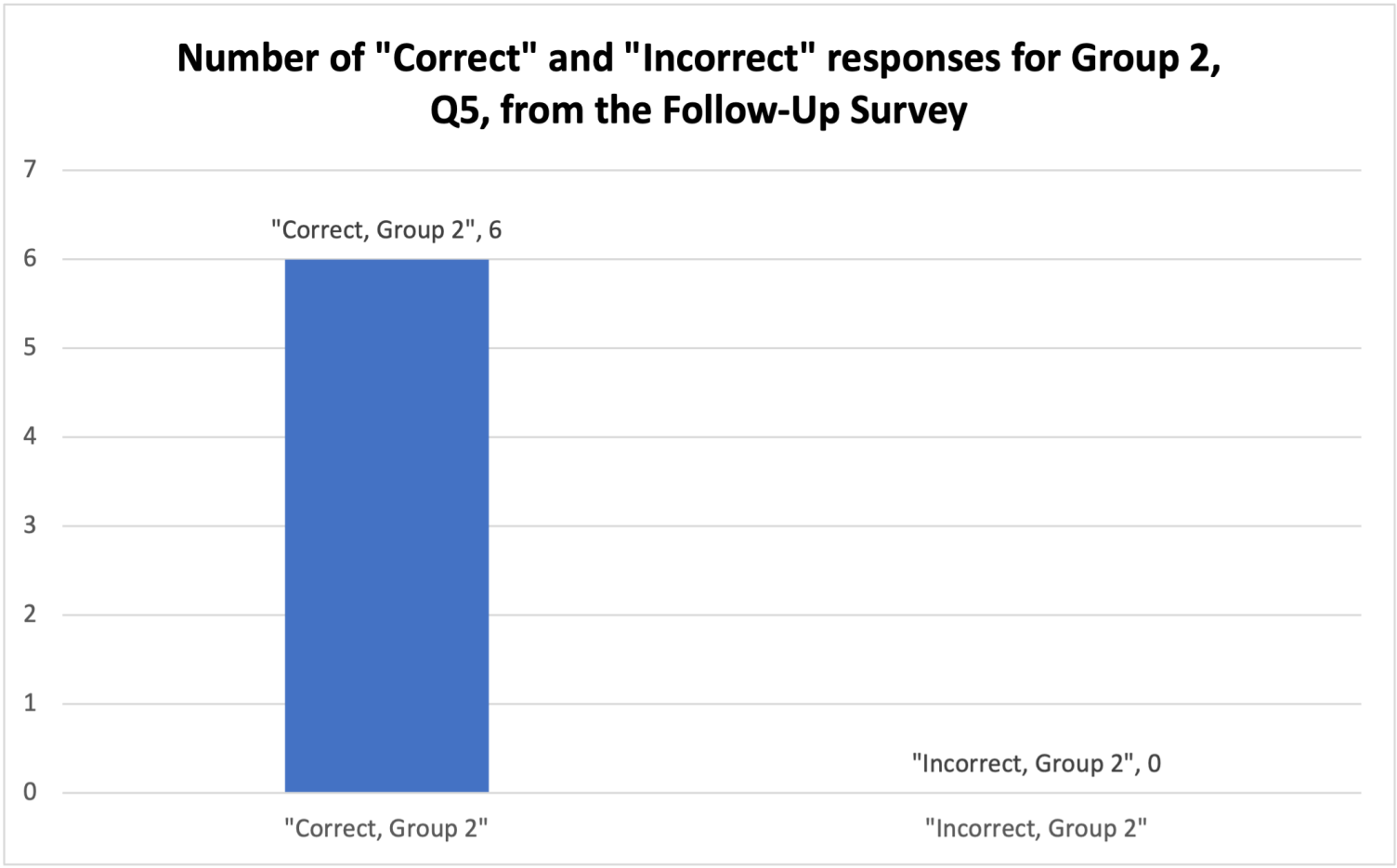
Bar Graph of Group 2, Q5, Responses

Initial Survey



Bar Graph of Group 2, Q5, Responses

Follow-Up Survey



Conclusion

- Overall, I found that the activity did not spur any substantial additional ChatGPT usage among respondents.
- I also found that the ChatGPT-assisted coding group outperformed the cooperative learning group in a logical error question in the initial survey and the follow-up survey. However, the cooperative learning group outperformed the ChatGPT assisted group in an indexing error question, both in the initial and follow-up survey.
- These results showcase that the knowledge retention rates varied by group for identifying different types of coding errors which resulted in overall comparatively similar retention rates between the two groups. This suggests that although the use of ChatGPT does not seemingly influence student comprehension rates, it could potentially replace peer cooperative learning in identifying errors in code.
- Lastly, more research and a larger study group could shed further light into the effects of Generative AI on student knowledge retention rates, as well as whether it can indeed replace peer cooperative learning, in areas other than coding as well.

Thank You!

Questions? Feedback?

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