MONASH University

FIT5125/4005
Research Methods in IT

Week 9 Assessment – Inferential Statistics
Assessment Template

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Question 1

I propose a hypothesis that pertains to statistical significance:
Do various learning methods exert distinct effects on memory?

Question 2

The null hypothesis in statistical hypothesis testing,usually indicating no effect,no association,no difference.It is a hypothesis that the researcher attempts to perform a statistical test to determine whether to reject or accept it. In hypothesis and alternative hypothesis. The null hypothesis is usually a default assumption,assuming that no significant effort or difference is found.In statistical analysis, the researcher will evaluate the validity of the null hypothesis based based on the sample data .If the data provide sufficient evidence that the null hypothesis and accept the alternative hypothesis is not valid, the researcher will reject the null hypothesis plays an important role in statistical inference and hypothesis testing, helping to determine whether a significant statistical relationship or effect exists.

The null hypothesis posits that there is no significant difference in memory effects between in memory effects between various learning methods.

Question 3

Hypothesis: I propose a hypothesis that different learning methods have varying effects on memory.

Null Hypothesis: The null hypothesis is that there is no significant difference in memory performance among individuals using different learning methods.

Independent Variable: The independent variable is the type of learning method, with categories such as 'Method A,' 'Method B,' and 'Method C.'

Dependent Variable:The dependent variable is memory performance, measured through memory tests or assessments.

Confounding Variables:
1. One potential confounding variable is participants' prior knowledge or experience related to the material being learned.
2. Another potential confounding variable is age, which can affect memory and should be controlled for.

c. Additionally, participants' motivation and interest in the learning material could impact memory performance and should be considered.

Question 4

project description:
My project aims to study the impact of different learning methods on memory performance, guessing that different learning methods may lead to different memory performance. This is an empirical study on educational psychology.

Data collection method:

1. Recruit participants: Use a portion of your budget to recruit participants. You can post research recruitment notices on internal university notification boards, online social media student groups, educational forums, etc. I can offer some small rewards or incentives to attract participants.

2. Questionnaire: Use an online questionnaire tool to create a questionnaire covering learning methods, subject background, study habits and memory performance. Make sure the questions are clear and the necessary data can be collected.

3. Classification of learning methods: Based on the participants' voluntary choices or answers in the questionnaire, participants are divided into different learning method groups, such as "Method A", "Method B" and "Method C".

4. Memory test: Use online memory test tools or standard memory tests, such as vocabulary tests or number recall tests, to test participants' memory performance. Ensure testing methods are consistent across groups.

5. Data recording: Record participants' learning method groups and memory performance scores. Store data in secure electronic files for subsequent analysis.

Data acquisition method:

1. Online questionnaire link: Send the questionnaire link to potential participants via email, social media, school notifications, etc. Online questionnaire tools are generally inexpensive and easy to use, making them suitable for large-scale data collection.

2. Laboratory Memory Test: Use part of your budget to rent laboratory space for memory performance testing. This ensures consistency and accuracy of experimental conditions. You can bring participants to the lab by appointment.

3. Data storage and analysis: Use free or open source statistical software (such as R or Python) to store and analyze data. This will help you with data cleaning, statistical analysis and generating results.

4. Research report: If my research results
If the results are significant, consider writing the research results into an academic paper or research report, and try to publish them in relevant academic journals.

Research Ethics: Before conducting data collection and analysis, ensure that informed consent is obtained from participants and that research ethics and privacy regulations are adhered to. Ensure participant data privacy is protected.

Question 5

Statistical Test: Mann-Whitney U Test

The Mann-Whitney U Test is an appropriate statistical test for our research hypothesis, which aims to determine whether different learning methods have varying effects on memory performance. In this specific instance, we are using the Mann-Whitney U Test to compare memory performance, a continuous variable, between two independent groups: Method A and Method B.

Assumptions:

Memory Performance Data: Memory performance data is at least ordinal, which is typically the case in studies measuring performance metrics.

Independence of Groups: The two groups, Method A and Method B, are independent of each other, with each participant assigned to only one of these methods.

Approximately Equal Variances: While the Mann-Whitney U Test is robust to unequal variances, it is still important to ensure that the variances in memory performance between Method A and Method B are not drastically different.

Why the Mann-Whitney U Test is Appropriate:

The Mann-Whitney U Test is a non-parametric test that is suitable for our analysis for several reasons:

Our memory performance data may not necessarily follow a normal distribution, and the Mann-Whitney U Test does not require this assumption.

We are comparing two independent groups (Method A and Method B) in our study, making the Mann-Whitney U Test an appropriate choice.

In cases where our sample sizes are relatively small, the Mann-Whitney U Test is more robust and suitable than parametric tests like the t-test.

By conducting the Mann-Whitney U Test, we can effectively assess whether there is a statistically significant difference in memory performance between Method A and Method B, providing valuable insights into the impact of different learning methods on memory.

participant	Learning Method A	Learning Method B
1	7	5
2	6	4
3	8	6
4	5	4
5	7	5
6	6	4
7	9	7
8	8	6
9	7	5
10	6	4
11	5	4
12	7	6
13	8	7
14	9	8
15	7	6
16	6	5
17	8	7

18	9	8
19	7	6
20	6	5

Question 6

The study exploring the effects of different learning methods on memory performance has several limitations. Firstly, the study's generalizability may be limited due to the specific sample used, which might not represent the broader population accurately. Secondly, controlling for all possible confounding variables, such as participants' motivation and prior knowledge, can be challenging, and there might be unaccounted factors influencing memory performance. Additionally, the study's duration might not capture long-term effects of learning methods on memory. For potential future investigations, conducting longitudinal studies to examine long-term effects and exploring the impact of various learning materials in real-world educational settings could provide valuable insights. Additionally, incorporating neuroimaging techniques to understand the neural mechanisms underlying memory performance differences could be an exciting avenue for further research.

1.Wilcoxon signed rank test:

The Wilcoxon signed-rank test is an appropriate non-parametric test when I want to compare "memory performance before" and "memory performance after" within the same group. It is suitable for situations where the data may not follow a normal distribution.

Assumptions:

Memory performance data should at least be in order.
Data should be paired, meaning there are two measurements for each participant.
Why it's appropriate:

The Wilcoxon signed-rank test is useful when:

My data does not meet the normality assumption, meaning it does not follow a normal distribution.
I have paired data, such as measuring the same participants before and after an intervention.
My data is ordered but does not meet the requirements of parametric testing.
Now, here's an example table summarizing the results of the Wilcoxon signed-rank test:

Learning Method	Memory Performance Before	Memory Performance After	Difference (After - Before)	Signed Rank	Absolute Signed Rank
Method A	85	92	7	+	7
Method B	78	79	1	+	1
Method C	90	88	-2	-	2
Method D	76	81	5	+	5
Method E	82	84	2	+	2

3. ANOVA (Analysis of Variance):This parametric test is appropriate when have more than two groups to compare memory performance (e.g., Method A, Method B, Method C).

Assumptions:
Memory performance data should be continuous and normally distributed within each group.
Homogeneity of variances assumption should be met (variances across groups should be roughly equal).

Why it's appropriate:

ANOVA allows to compare multiple groups simultaneously, providing insights into whether there are significant differences in memory performance among different learning methods.

Learning Method	Memory Performance
Method A	85
Method A	92
Method A	78
Method A	88
Method A	90
Method B	76
Method B	81
Method B	82
Method B	79
Method B	84
Method C	91
Method C	88
Method C	86
Method C	87
Method C	89
Method D	80
Method D	78
Method D	82
Method D	85
Method D	81
Method E	90
Method E	87
Method E	84
Method E	88
Method E	86

Question 7

Certainly, let's consider a different narrative that could arise from the results, potentially leading to changes in data selection, methods, or processes for a different interpretation:

Alternate Narrative: The Impact of Sample Selection on Memory Performance

In the initial analysis, we explored the impact of different learning methods (Method A, Method B, Method C, Method D, and Method E) on memory performance. However, upon closer examination, it becomes evident that the sample selection process might have played a crucial role in the observed outcomes.

In the original dataset, participants were selected from a diverse population, and the learning methods were assigned randomly. But what if we consider the possibility that participants who chose Method A and Method B were inherently more motivated or engaged with the learning material than those who ended up in Method C, Method D, or Method E? This motivation or enthusiasm could have positively influenced their memory performance, thereby leading to the observed differences.

To support this alternate interpretation, a new study design could involve pre-screening participants for their baseline motivation levels or enthusiasm for the learning material. Then, participants could be assigned to different learning methods based on their motivation levels. This revised approach would address the confounding variable of motivation more directly.

Additionally, conducting qualitative interviews or surveys to gauge participants' interest and engagement with the learning material might provide valuable insights into the relationship between motivation, learning methods, and memory performance.

In summary, this alternate narrative suggests that the observed differences in memory performance may have been influenced by participant motivation and enthusiasm for the learning material. Future studies could benefit from a revised data selection process that accounts for these motivational factors and explores their impact on memory outcomes in more detail.