Analysis of Messaging Update Times Across Two Email Interfaces

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Introduction and Problem Background

Through a secure email system, AMS communicates with cable subscribers using digital messaging systems to inform customers about service changes, new features, and billing information. AMS prioritizes timely updates regarding its messaging system to maximize customer satisfaction rates and information delivery. To do this, AMS wants to reduce the time required for messages to update in the system. An experiment was conducted where the two alternative interfaces were considered (Interface 1 vs. Interface 2) to see which system performs more efficiently. 30 randomly selected subscribers of AMS's services were chosen. Between the chosen subscribers, they were evenly divided into two groups. 15 subscribers were assigned to Interface 1, and the other 15 were assigned to Interface 2. The update-time data provided was recorded in seconds. Because each subscriber was assigned to only one interface, we can retrieve data from independent groups. Therefore, by comparing these two systems, a two-sample t-test was conducted for independent means (averages).

Analysis of Update Time Performance (Independent Samples & Paired Samples)

Measure	**Independent Samples**	**Paired Samples**
Sample Size	n_1 =15, n_2 = 15	n = 15 pairs
Mean Difference	-0.398	-0.398
Standard Deviation	s1 = 0.298, s2 = 0.357	s = 0.4286
Standard Error	0.12005951	0.11066982
Degrees of Freedom	27	14
t-Statistic (Tobs)	-3.31502272	-3.596283
p-Value	0.0026192	0.00291994
95% Confidence Interval for Mean Difference	(-0.644, -0.152)	(-0.635, -0.161)

Conclusion	Interface 1 is faster	Interface 1 is faster

Descriptive statistics show that the average update time under Interface 1 was approximately 3.67 seconds when compared with 4.07 seconds for Interface 2. This data suggests that Interface 1 generally updated messages more quickly by -0.398 seconds. Interface 1 also showed slightly lower variability (standard deviation) than Interface 2, suggesting a more consistent performance. To statistically compare, the 95% confidence interval for the difference in mean update times ranged from an upper limit of -0.644 to a lower limit of -0.152 seconds. This means that Interface 1 is estimated to update messages between 0.15 and 0.64 seconds faster than Interface 2 (the entire interval being negative). When hypothesis testing, the two-sample t-test produced a test statistic of -3.315 with a p-value of 0.0026. Because this p-value is below 0.05, we reject the null hypothesis in favor of the alternative hypothesis and conclude that the two interfaces do not perform equally. Interface 1 strongly demonstrates significantly higher, faster update times.

Using the new suppositions and changes to our research design described in the case, only 15 subscribers were chosen to use both interfaces, with their sample times paired. Since each subscriber was measured under both interfaces, update times are no longer independent. The new appropriate method for analyzing the redesigned case is using a paired t-test based on the difference in update times for each subscriber. Between the paired sample times, there is a difference of approximately -0.398 seconds. The standard deviation of the differences can be rounded to 0.429, where its standard error is approximately 0.111. Using these paired descriptive statistics, our paired test results show a test statistic of -3.596 and a p-value of 0.0029. This strongly provides evidence that the two interfaces differ in performance yet again. Because the

mean difference was negative, Interface 1 remained the faster option. To further support our test, a 95% confidence interval was calculated for the mean difference. Data shows a range from -0.635 to -0.161 seconds, proving that Interface 1 was between 0.16 and 0.64 seconds faster for the same subscriber in comparison to Interface 2.

Interpretations of Results and Conclusion for AMS Operations

In conclusion, both the independent and paired samples, along with their testing, provide strong evidence to conclude that Interface 1 updates more messages quickly than Interface 2. The two tests are statistically significant due to their confidence intervals being negative. Because faster message delivery greatly enhances customer communication and satisfaction rates, AMS would greatly benefit from adopting Interface 1 as its standard messaging system.