

# Software Measurement - 6611

## Assignment – 3

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**Overview :** The overall objective of this assignment is to evaluate the quality-in-use measurements for both the mobile user interface and the desktop user interface of the Concordia University website to determine whether there is a significant difference in quality between them. In order to collect the data necessary to evaluate the quality-in-use values, users will be asked to perform three tasks on both a desktop environment and a mobile environment. They will then fill out a questionnaire to rate the satisfaction of the tasks performed in both the mobile user interface and desktop user interface. With these responses we will be able to evaluate the Effectiveness, Productivity, task efficiency, safety and task navigation for both the desktop user interface (DUI) and the mobile user interface (MUI) and perform statistical analysis upon the results to draw up conclusions about the quality of the designs.

### Quality-in-Use Model

The Quality-in-use characteristics as defined in ISO/IEC 9126-4 are as follows:

**Effectiveness** - The capability of the software product to enable users to achieve specified goals fully and accurately

**Productivity** - The capability of the software product to enable users to consume appropriate amounts of resources to complete the task, such as

time, or the effectiveness of the software product relative to the effort expended by the user

**Safety** - The capability of the software product to limit the risk of harm to people, businesses, software, property, and the environment to an acceptable level

**Satisfaction** - The user's response to interacting with the software product, which includes his/her attitudes towards using the product.

**Task Efficiency** - Effectiveness of the user in completing the task in a specified context of use

**Task Navigation** - The user's cognitive load measured by the total number of actions relative to the number of views in a specified context of use

**Website Overview :** Concordia.ca is a high traffic website whose primary user base is both current and prospective students, as well as the faculty and staff of Concordia University. Its main purpose is to serve as a point of information on anything pertaining to the institution. Among which includes: academic information regarding the various degrees offered, information pertaining to admission, etc. In order to provide an experience across all devices, both a desktop user interface and a mobile user interface exists.

## **Design - Hypotheses :**

### **Effectiveness Hypotheses:**

**Null Hypotheses I :** There is no significant difference between the quality of the Concordia website using the MUI versus using the DUI based on the effectiveness of the website.

**Alternative Hypothesis I for null Hypothesis I:** The effectiveness of the Concordia website using the DUI is less than the effectiveness of the website using the MUI.

**Alternative Hypothesis II for null Hypothesis I:** The effectiveness of the Concordia website using the MUI is less than the effectiveness of the website using the DUI.

### **Productivity Hypotheses:**

**Null Hypothesis II:** There is no significant difference between the quality of the Concordia website using the MUI versus using the DUI based on the Productivity of the website.

**Alternative Hypothesis I for null Hypothesis II:** The productivity of the Concordia website using the DUI is less than the productivity of the website using the MUI.

**Alternative Hypothesis II for null Hypothesis II:** The productivity of the Concordia website using the MUI is less than the productivity of the website using the DUI.

### **Task Efficiency Hypotheses:**

**Null Hypothesis III:** There is no significant difference between the quality of the Concordia website using the MUI versus using the DUI based on the task efficiency of the website.

**Alternative Hypothesis I for null Hypothesis III:** The task efficiency of the Concordia website using the DUI is less than the task efficiency of the website using the MUI.

**Alternative Hypothesis II for null Hypothesis III:** The task efficiency of the Concordia website using the MUI is less than the task efficiency of the website using the DUI.

### **Safety Hypotheses :**

**Null Hypothesis IV:** There is no significant difference between the quality of the Concordia website using the MUI versus using the DUI based on the safety of the website.

**Alternative Hypothesis I for null Hypothesis IV:** The safety of the Concordia website using the DUI is less than the safety of the website using the MUI.

**Alternative Hypothesis II for null Hypothesis IV:** The safety of the Concordia website using the MUI is less than the safety of the website using the DUI.

### **Task Navigation Hypotheses :**

**Null Hypothesis V:** There is no significant difference between the quality of the Concordia website using the MUI versus using the DUI based on the task navigation of the website.

**Alternative Hypothesis I for null Hypothesis V:** The task navigation of the Concordia website using the DUI is less than the task navigation of the website using the MUI.

**Alternative Hypothesis II for null Hypothesis V:** The task navigation of the Concordia website using the MUI is less than the task navigation of the website using the DUI.

### **Experiment:**

For the experiment, 5 of my colleagues from my course **SOEN-6611** were asked to perform some general tasks on the Concordia.ca webpage. The actions that the subjects performed were then recorded by me to determine the efficiency of each subject completing the task. The subject was assumed to have minimal to average previous experience with the Concordia.ca website.

The criterion for the efficiency of navigating to the specified page is categorized as follows:

**NV – Number of Views** changed in order to complete the task successfully

**NA – Number of Correct** actions in each task

**NI – Number of Incorrect** actions in each task

**Time** – Time from start of task until completion

For the experiment there were 3 tasks that the subjects completed.

1. Search for full "Graduate Admissions" on the Concordia Website

2. View the full program details for Software Engineering(MEng)
3. Ask a question – How do I apply

The execution of each is described in the **“Execution Section”**.

After the tasks were completed on the desktop, the subjects were asked to complete the same tasks again on a mobile device.

## **Subjects**

### **Subject – SOEN 6611 Student**

**Description :** A SOEN 6611 Student is a person working on completing a master's degree in engineering with a specialization in Software at Concordia University. He, on average, is between the age of 23 and 35 and has a fair amount of technical knowledge and experience with the Concordia.ca website.

**Role :** Serve as the test subject for the experiment.

## **Objects**

### **Object – Desktop Computer**

**Description:** The Desktop Computer serves as a stationary platform for personal computing. The specifications for the device used in the experiment follow.

**Role:** Serve as the testing environment for the desktop user interface (DUI).

**Model:** Macbook Air

**Operating System:** MacOS Monterey

**Processor:** Intel Core i7

**Ram:** 8GB

**Graphics:** Intel Integrated HD Graphics 6000

**Weight:** 2.8 pounds

**Dimensions:** 304.1 x 212.4 x 16.1 mm (11.97 x 8.36 x 0.63 inches)

## **Object – SmartPhone**

**Description:** Although the Smartphone's primary focus is telecommunication, it strives to be a medium of mobile personal computation. The specifications of the devices used in the experiment follow.

**Role:** Serve as the testing environment for the mobile user interface (MUI).

**Model:** Iphone 13 pro

**Operating System:** IOS 15

**Processor:** A15 Bionic

**Ram:** 6GB

**Browser:** Chrome

**Weight:** 7.19 ounces

**Wifi Connection:** Concordia Wifi

**Dimensions:** 5.78 x 2.82 x .30 inches

## **Execution**

Note: all tasks begin at [www.concordia.ca](http://www.concordia.ca)

### **Task 1 – Graduate Admission**

Search for "Graduate Admissions" on the Concordia Website

#### **Task Steps:**

- Click in the Search box on the main page. (The search box is located at the top right of the home page, below the burgandy box that says "Quick Links")
- Type in "Graduate Admissions"
- Click the search icon located directly to the right of the search box, the browser will now be redirected to <https://www.concordia.ca/search.html?search-mode=concordia-search&q=graduate+admission>
- Select the first option from the list of returned titled "Graduate" which will redirect to <https://www.concordia.ca/admissions/graduate.html>

**Successful Conclusion:**

- ✓ The graduate admission page is displayed

**Common Incorrect Actions:**

- ✗ The option for Graduate Admissions could be easily missed because it only says "Graduate". This could lead to students continuing to browse the search results without finding what they are looking for.

**Task 2 – View Program Details**

View the Full Program Details for Software Engineering (MEng)

**Task Steps:**

- Click on 'Programs' under 'Graduate Admissions'
- It will redirect you to  
<https://www.concordia.ca/admissions/graduate/programs.html>
- Scroll down and find Software Engineering(MEng)
- Click on the down arrow on the left side to expand the details
- Click on the "View program details"
- It will redirect you to  
<https://www.concordia.ca/academics/graduate/software-engineering-meng.html>

**Successful Conclusion:**

- ✓ Software Engineering(MEng) program page is displayed

**Common Incorrect Actions:**

- ✗ There are Software Engineering(MASc) and Software Engineering(Phd) before and after Software Engineering(MEng) program respectively. This could mislead to students if not careful.

### **Task 3 – Ask a Question**

Ask a question ? How do I apply?

#### **Task Steps:**

- Scroll down and find “Application Process”
- Click on “Review these four steps before applying”
- It will redirect you to  
<https://www.concordia.ca/admissions/graduate/requirements.html>
- Scroll down again and find “Ask a question” at the bottom
- Click on this and it will redirect you  
<https://www.concordia.ca/admissions/questions.html>
- It will show you the questionnaire “What will best describe you?”
- Select which one suits you better
- You can continue if you are not satisfied with the answers

#### **Successful Conclusion:**

- ✓ The answer to “How do I apply” is answered by displaying information pertaining to the application to Concordia University.

#### **Common Incorrect Actions:**

- ✗ Subjects may expect to find the Ask a question option in a different part of the page...possibly as a default option near the top of the home screen.
- ✗ In this task it can be difficult to spot the menu for prospective students because the user must scroll down.
- ✗ Subjects may make the mistake of looking for the “ask a question” in the “About” menu. This will likely lead to the user becoming lost, and will greatly increase the number of Incorrect Actions, and time to complete.

**Paper Log-in Form:** In zip file – Login Form Folder

**Subjective Measure:** In zip file – Questionnaire Folder

**The Participants:** In excel file – **profile excel sheet**



## Analysis

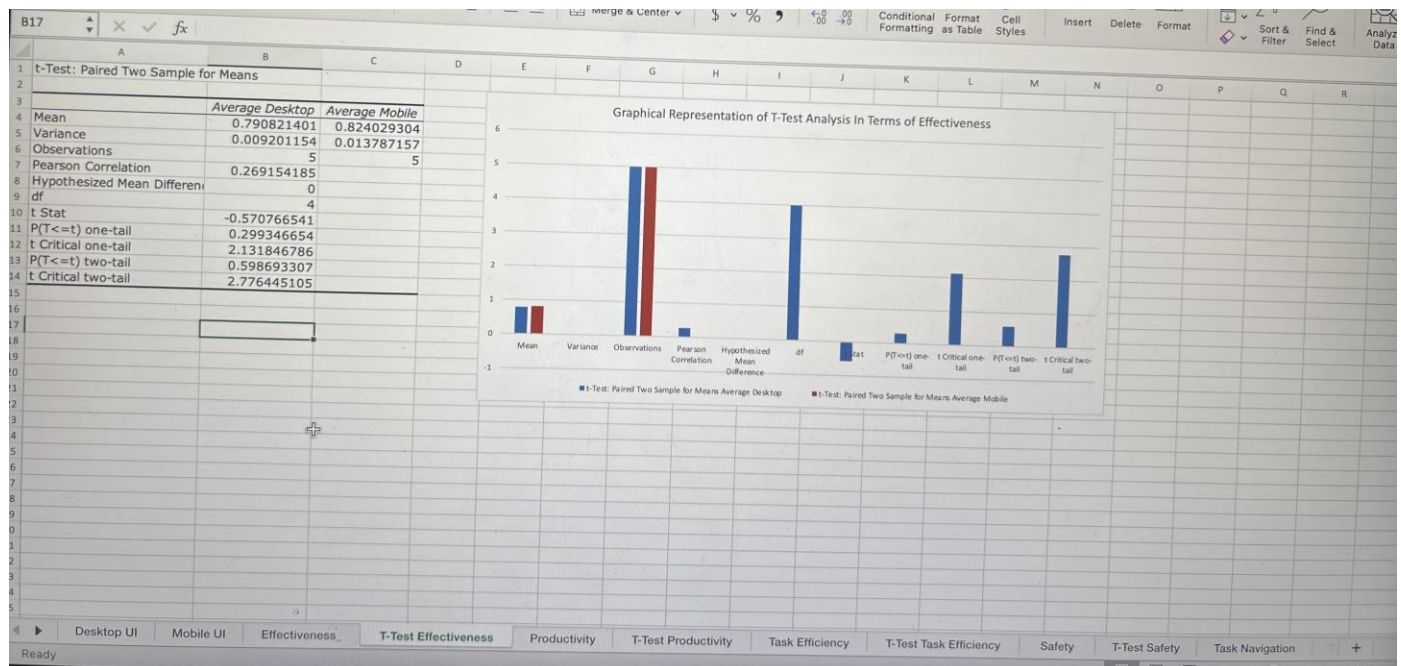
### Raw Measurement Data:

**For Desktop** – attached in Excel sheet – **Desktop UI**

**For Mobile** – attached in Excel sheet – **Mobile UI**

### Effectiveness :





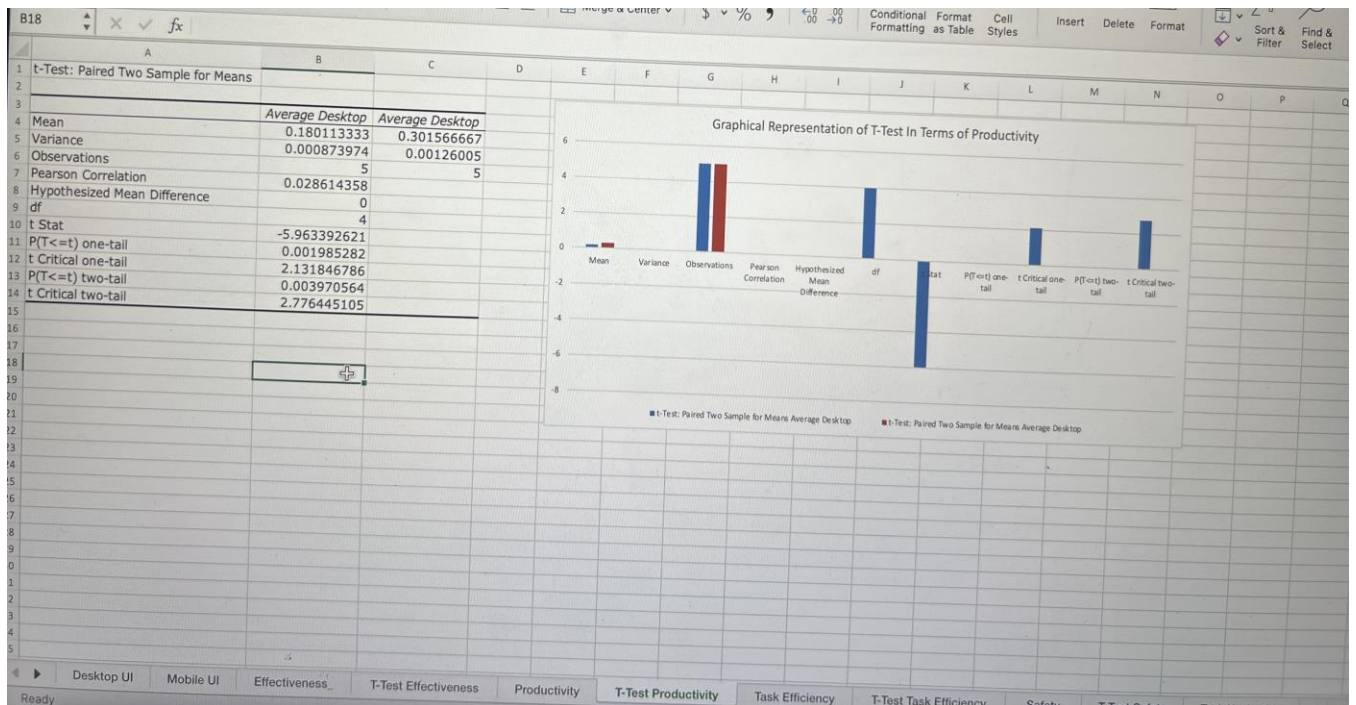
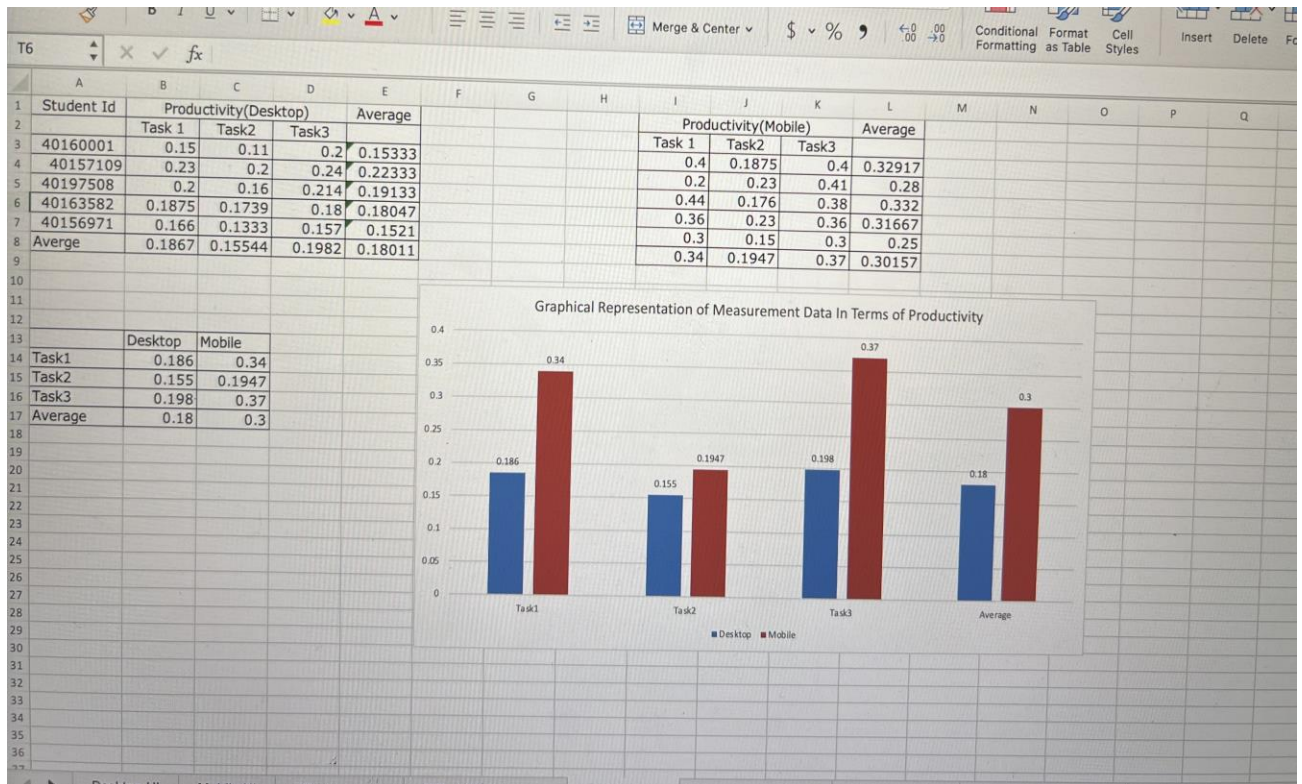
## Analysis

Since the p value of the two tails for (Effectiveness) is  $0.59 > \alpha$  (0.05). (Using a confidence level of 5%)

We can not reject the null hypothesis for this factor

So, there is no significant difference between the effectiveness of the DUI and the MUI.

## Productivity:



**Analysis:**



Since the p value of the two tails for (Productivity) is  $0.0039 < \alpha (0.05)$ .  
(Using a confidence level of 5%)

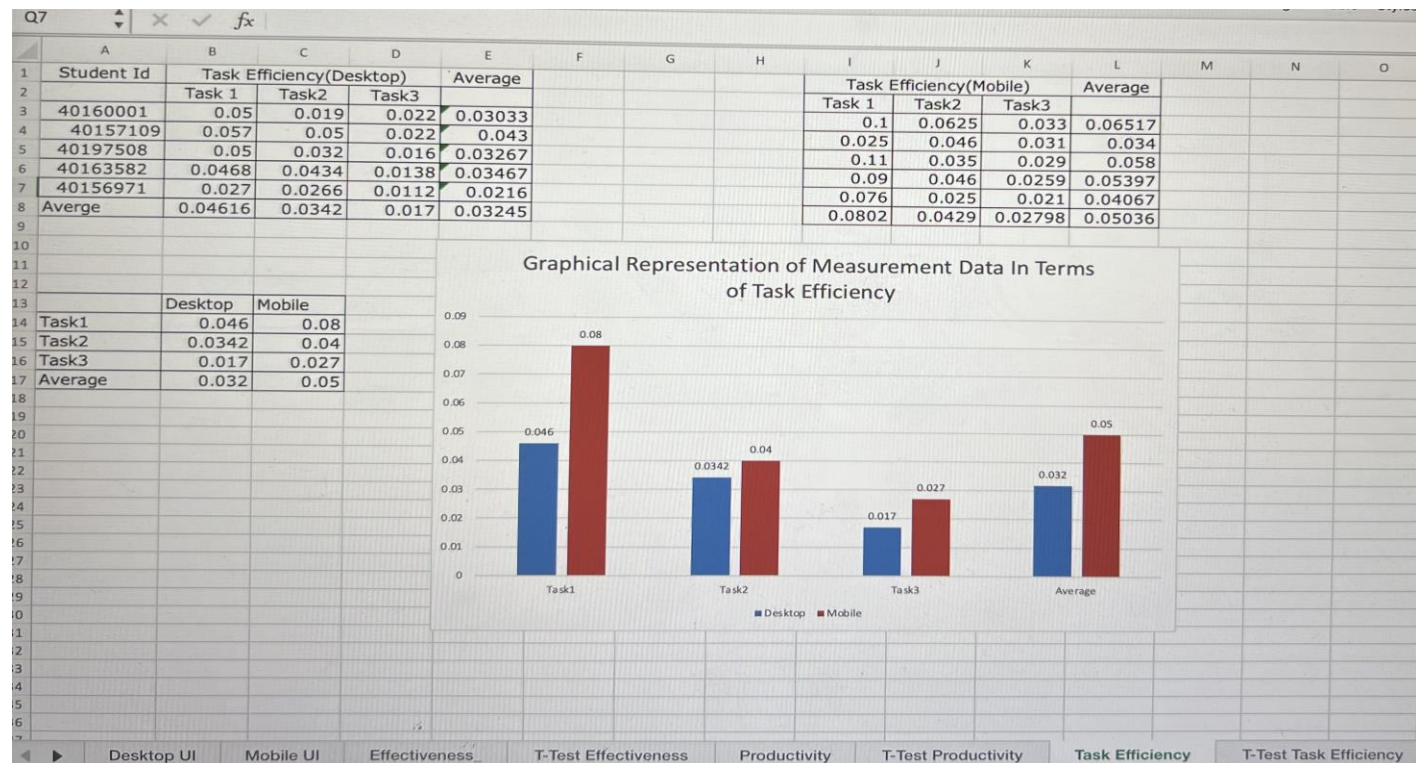
We can reject the null hypothesis for this factor

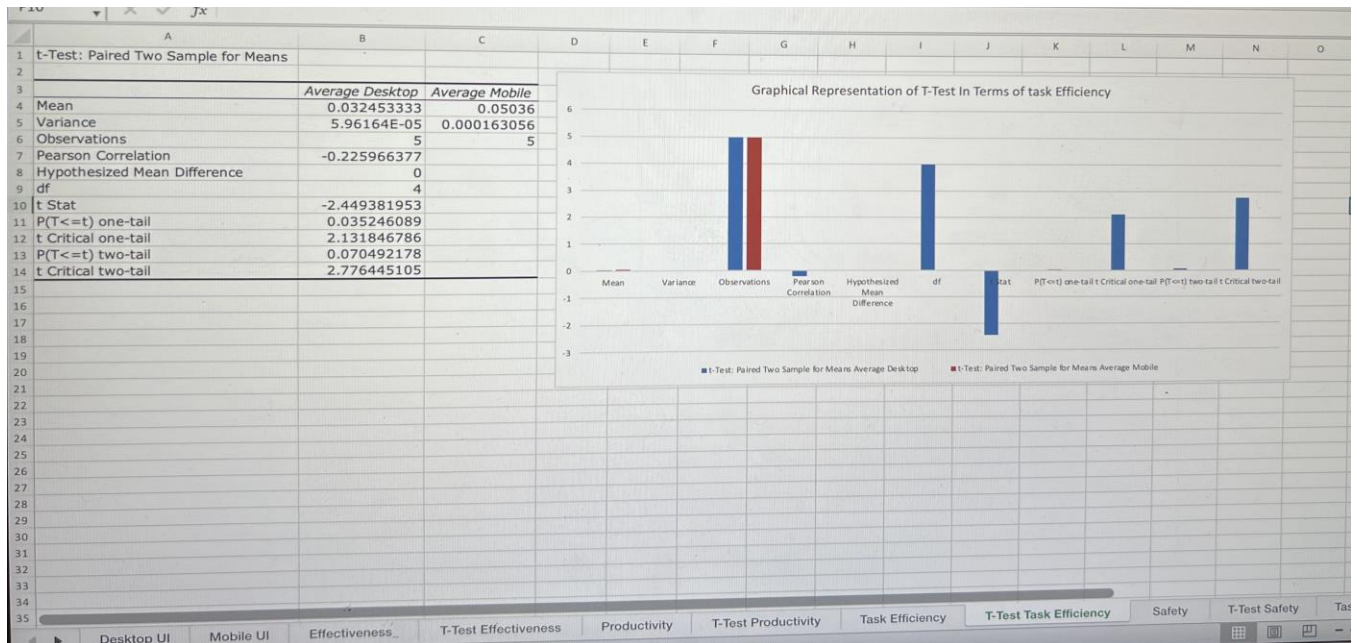
We have to therefore assess the alternative hypotheses:

The objective factors support the hypothesis that the mobile UI productivity is greater than the desktop UI. Because the mean value for mobile UI productivity is 0.3 whereas the desktop UI productivity is 0.18

We therefore accept the **Alternative Hypothesis I for null Hypothesis II:**  
The productivity of the Concordia website using the DUI is less than the productivity of the website using the MUI.

## Task Efficiency:





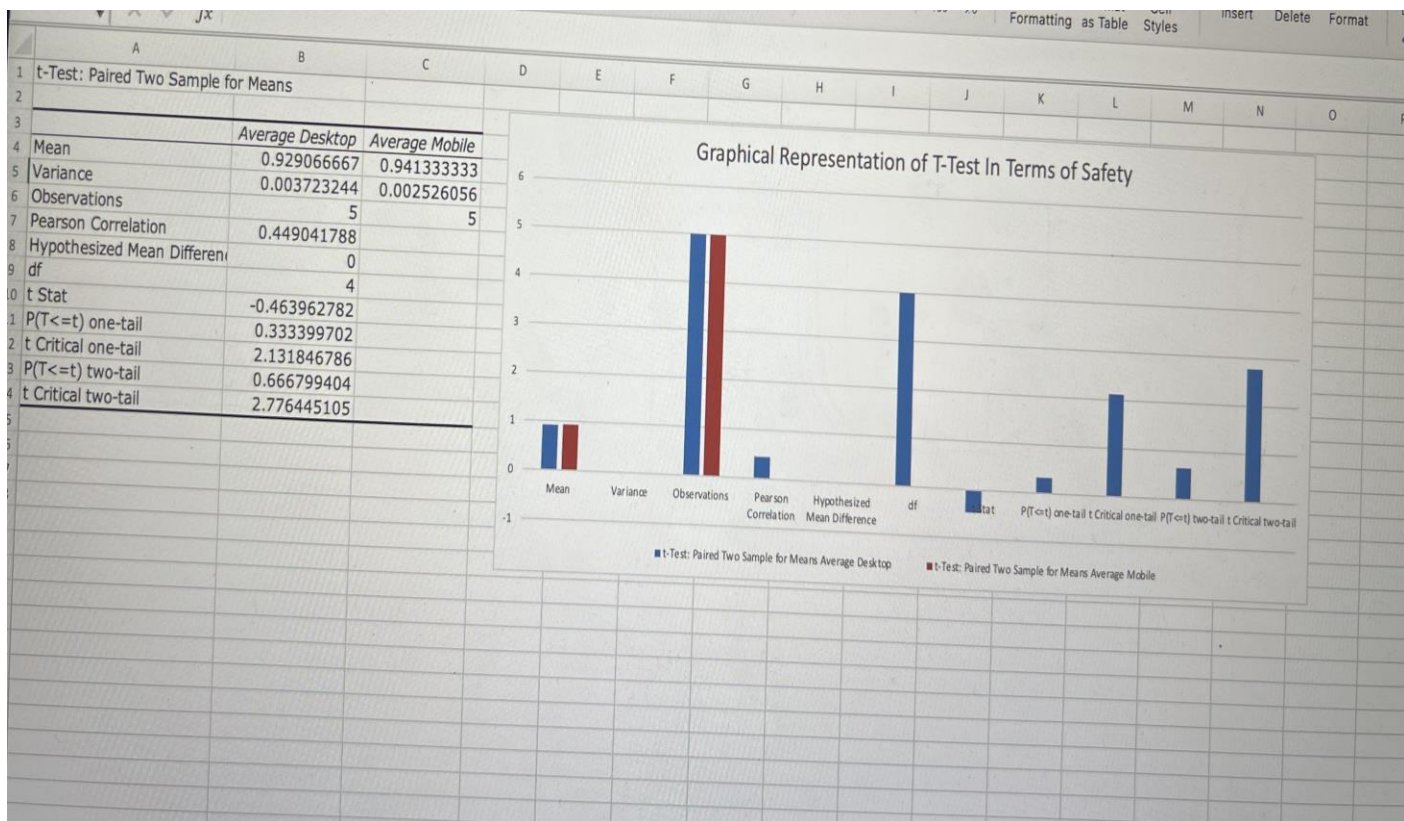
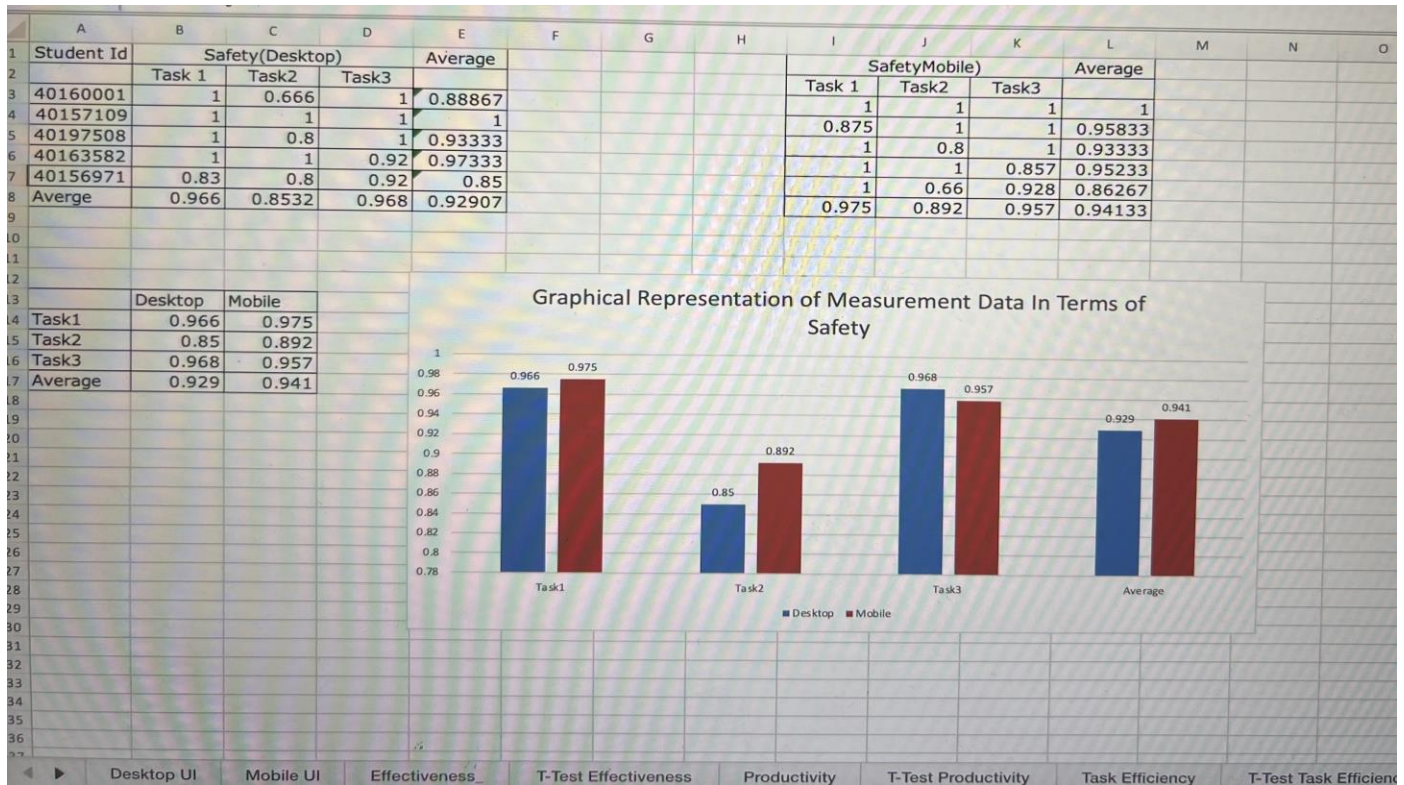
## Analysis:

Since the p value of the two tails for (Task Efficiency) is  $0.070 > \alpha$  (0.05). (Using a confidence level of 5%)

We can not reject the null hypothesis for this factor

So, there is no significant difference between the Task Efficiency of the DUI and the MUI.

## Safety:





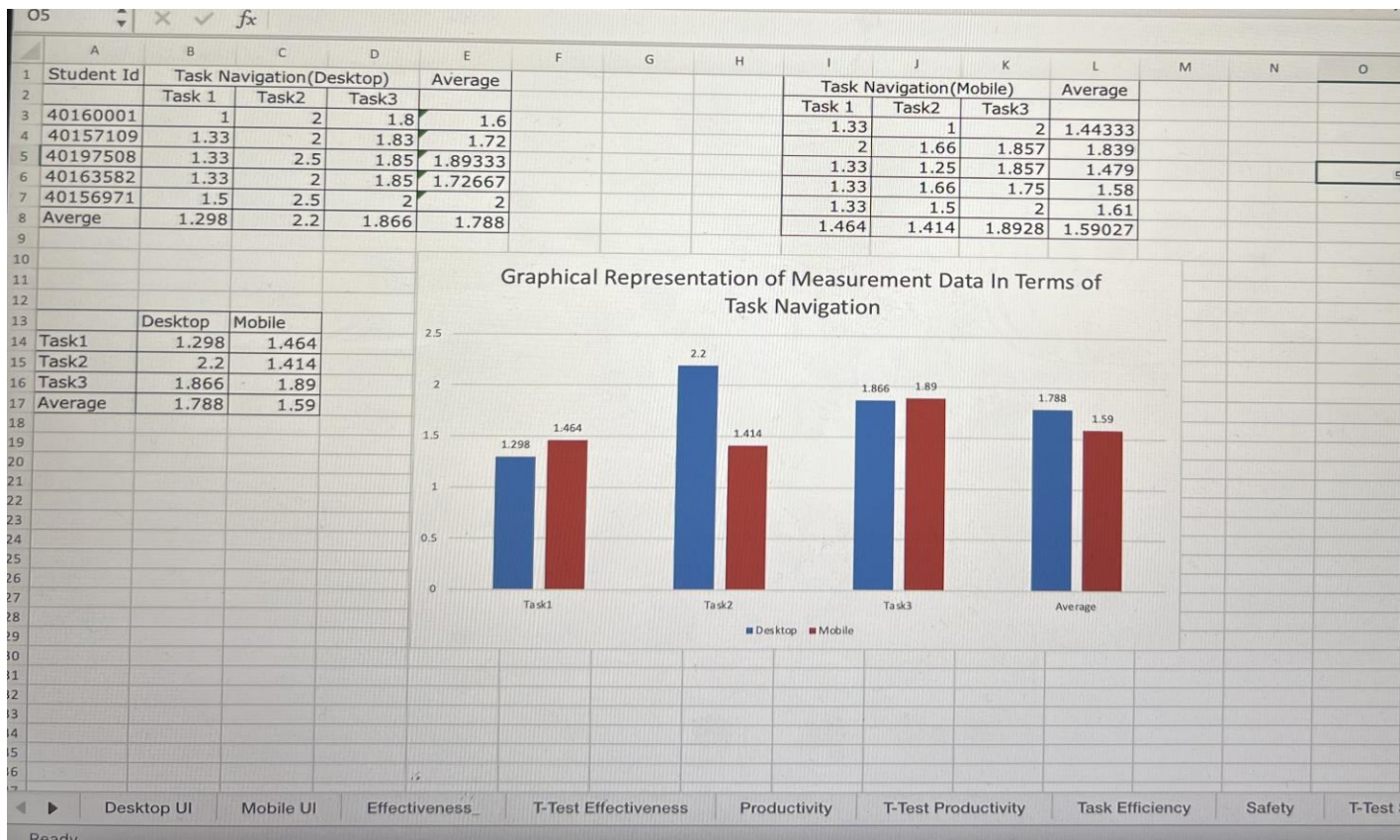
## Analysis:

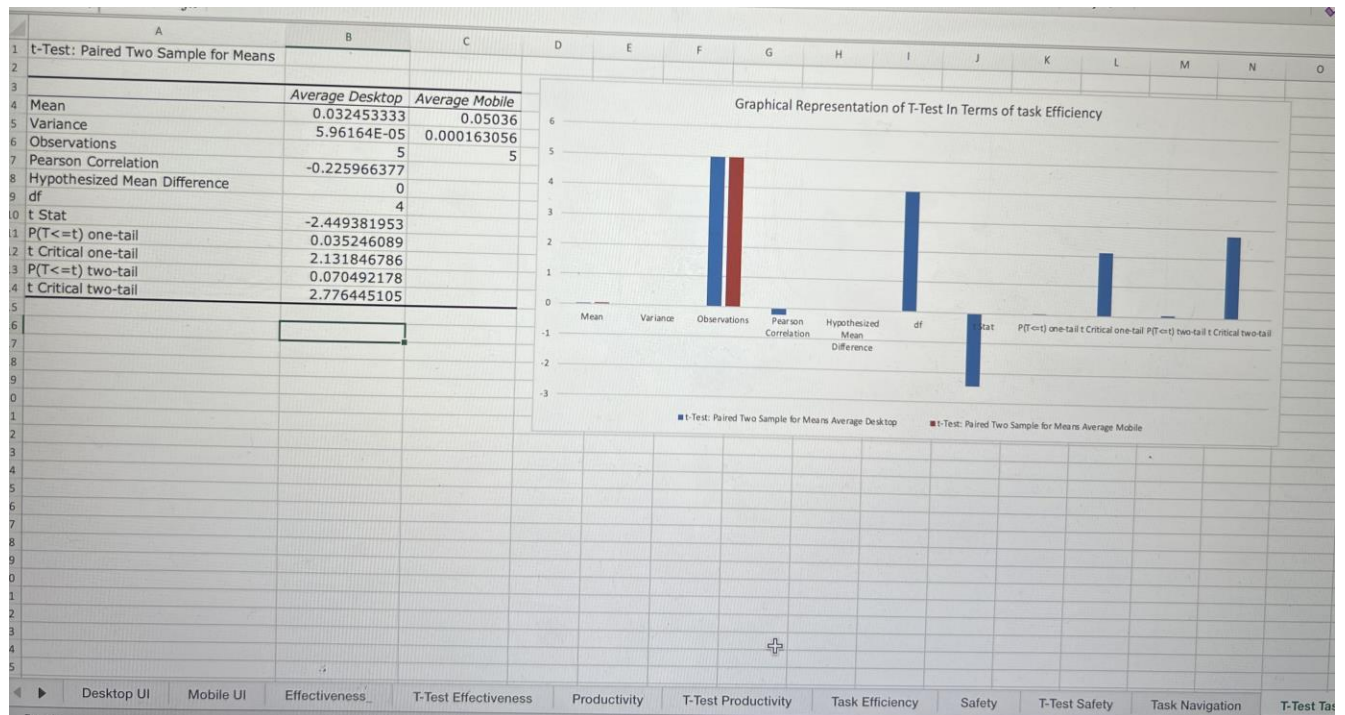
Since the p value of the two tails for (Safety) is  $0.66 > \alpha (0.05)$ . (Using a confidence level of 5%)

We can not reject the null hypothesis for this factor

So, there is no significant difference between the Safety of the DUI and the MUI.

## Task Navigation:





## Analysis:

Since the p value of the two tails for (Task Navigation) is  $0.07 > \alpha$  (0.05). (Using a confidence level of 5%)

We cannot reject the null hypothesis for this factor

So, there is no significant difference between the Task Navigation of the DUI and the MUI.

## Dissemination

Our results clearly show a significant discrepancy in between the MUI and DUI favoring the desktop in most of the Quality-in-use factors. To facilitate the decision making we show the percent difference between the two in the following tables:



## Desktop UI vs. Mobile UI Percent Difference

### Effectiveness:

	Value
Task1	16.667% -
Task2	22.3529% +
Task3	15.495% -
Average	3.6585% -

### Productivity:

	Value
Task1	45.294% -
Task2	20.39% -
Task3	46.486% -
Average	40% -

### Task Efficiency:

	Value
Task1	42.5% -
Task2	14.5% -
Task3	37.037% -
Average	36% -

### Safety:

	Value
Task1	0.9231% -
Task2	4.7085% -
Task3	1.13636% +
Average	1.2752% -

### Task Navigation:

	Value
Task1	11.339% -
Task2	55.587% +
Task3	1.2698% -
Average	11.0738% +

### Decision-Making

The results clearly show that the desktop UI is better than the mobile UI in almost every aspect other than navigation. Both UIs are about equal in terms of navigation in tasks2 and task3). This means that the user can process input and output around the same across both the desktop and mobile UIs.

The core problems are the mobile UI's poor efficiency, productivity, and effectiveness. There is a 36% decrease in efficiency, a 40% decrease in productivity, and a 3.6585% decrease in effectiveness across the desktop and the mobile UIs. A lower efficiency causes the user to take longer to complete a desired task. A low productivity means that the user has to perform more actions to perform a task. The lower effectiveness means a higher number of actions are required to complete a subtask. Although we rejected the null hypothesis in terms of productivity.

In order to increase the productivity we need to reduce the user's actions to perform the user's desired task; to increase efficiency we must have the user complete the task quicker; and, finally, to increase the effectiveness we must decrease the number of actions between subtasks.