

VDOT Learnability Study

This study was designed to observe in what way users develop their skills navigating the new ventilator design

Seven subjects were given 15 tasks, each day, for 5 days

Users also filled out 4 subjective surveys, Monday, Wednesday, and Friday

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Jim Kleiss



Questions covered 15 UI navigation categories

1 Quick Key Change

2 Mode Change

3 Menu Selection

4 Silence Alarm

5 Identify Alarm

6 Setup Alarm

7 Snap Shots

8 Configure Patient Graphics

9 Select Patient View

10 Select Trend Tools

11 Identify Trend Values

12 Review Alarm History

13 Select Clinical Decision Support Tools

14 Put System into Standby

15 Select / Use Favorites



The 5 questions written for each category, one for each day

“Menu selection”

Day 1: Select the “Spontaneous Breathing Test” (SBT) tool.

Day 2 Select the “Lung Mechanics” tool.

Day 3: Select the “Suction” Tool.

Day 4: Select the “Nebulizer” Tool.

Day 5: Select the “Procedures” Tool.

The Hypothesis

Subjects will learn the locations of the controls and then task times will decline

The null hypothesis:

Subjects will not learn the locations of the controls and task times will not decline

P Values less than .05 - indicate that the null hypothesis should be rejected

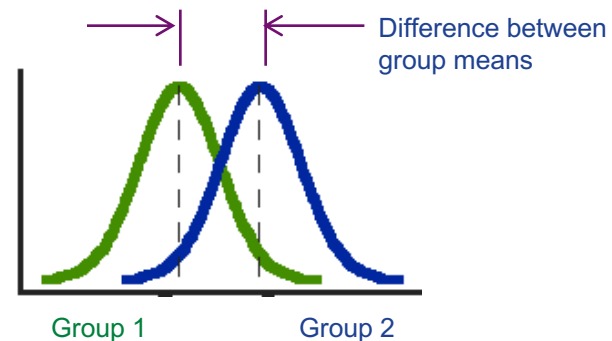
Microsoft Excel will do the T Test math for you!

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

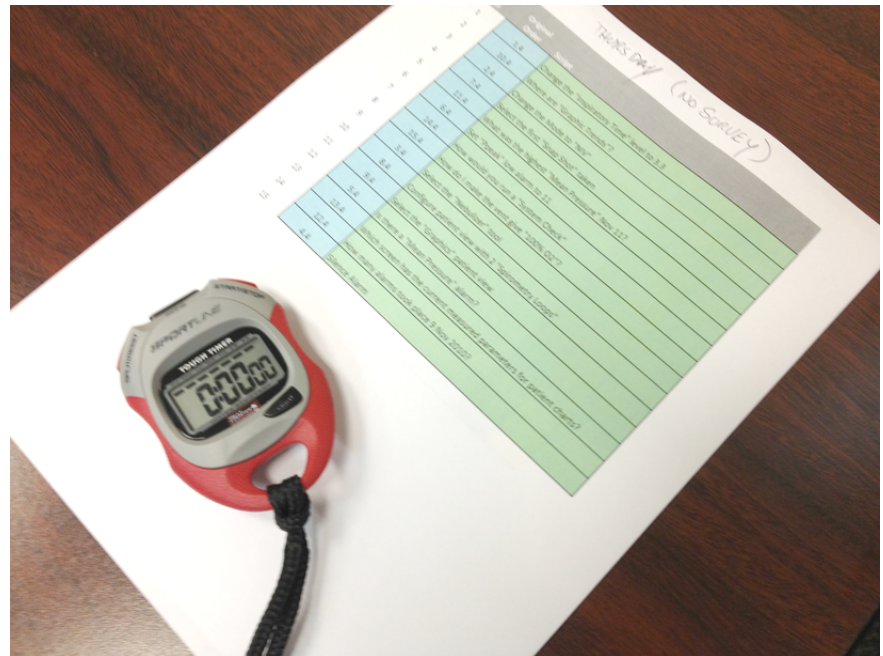
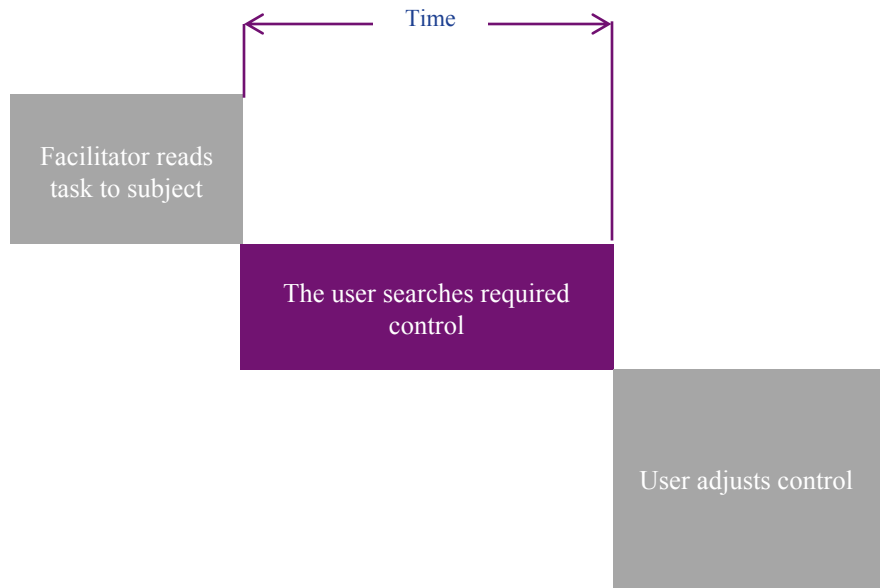
where

$$S_{X_1 X_2} = \sqrt{\frac{1}{2}(S_{X_1}^2 + S_{X_2}^2)}$$

The t-test assesses whether the means of two groups are *statistically* different from each other. This analysis is appropriate whenever you want to compare the means of two groups,



Timing focused on the navigation... not the adjustment of the value



Scoring task completion and time was done in Excel captured by co-facilitator

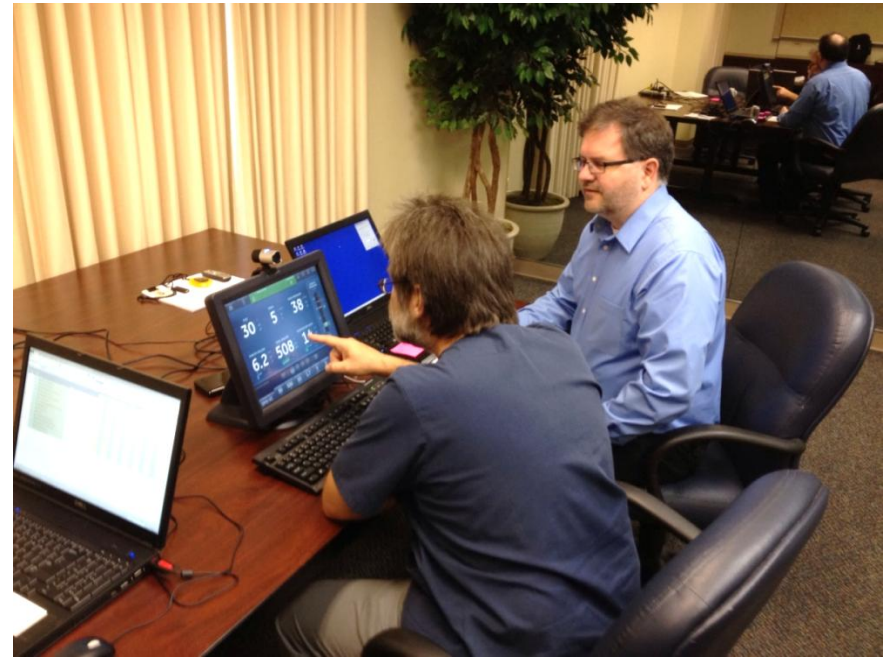
Tasks

User1 User2....

E	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
Original Order	Script	Expected	Yelena	Time	Rick	Time	Kerry	Time	Leah	Time	Aaron	Time	John	Time	Brian	Time
1.1	Change the "PEEP" level to 9	use key pad to chg. PEEP	1	20	1	2	1	3	1	2	1	2	1	3	1	2
2.1	Change the Mode to "VCV"	select mode from footer, select mode, confirm	1	6	1	4	1	4	1	3	1	4	1	4	1	7
3.1	Select the "Spontaneous Breathing Test" (SBT) tool	menu selection	0	60	1	7	0	60	1	31	0	60	1	31	0	60
4.1	Silence the Alarm	click left side of alarm bar	1	4	1	10	0	60	1	27	1	8	1	7	1	34
5.1	Is there a "Minute Volume" alarm?	Current Alarms, Mvexp Low, Yes	1	22	0	60	1	4	1	6	1	17	1	8	1	8
6.1	Set "Ppeak" low alarm limit to 6	Alarm Setup, Ppeak, down arrow, return	1	6	1	6	1	4	1	3	1	4	1	10	1	6
7.1	Select Snap Shot from 10 Nov 9:28am	open trends, snapshot button,	0	60	0	60	0	60	0	60	0	60	0	60	0	60
8.1	Configure the patient view with 2 spirometry loops	patient view 4, config., F-V Flow and volume	0	60	1	31	1	30	1	12	1	8	0	60	1	17
9.1	Select "Basic" patient monitoring view	patient view, button 1	1	13	1	4	1	2	1	8	1	2	1	4	1	2
10.1	Where do I find "Alarm History"?	Trends, Alarm History	0	60	1	6	1	20	1	28	0	60	1	59	1	11
11.1	What was the highest "Expired Minute Volume" Nov 11th	Trends, Graphic Trends, cursor scrub, minute volume =15	0	60	1	59	1	30	1	50	0	60	1	17	0	60
12.1	How many alarms took place Nov 11?	Trends, Alarm History, Count = 8	0	60	1	4	1	12	1	20	1	11	1	9	1	7
13.1	Where do I find "Functional Residual Capacity (FRC)"?	"Future Tools", FRC	0	60	1	7	1	38	1	6	0	60	0	60	1	12
14.1	How do I put the system into "Standby"?	Select standby, pause ventilation	1	5	1	7	1	3	1	6	1	3	1	17	1	3
15.1	How do I initiate an "Inspiratory Hold"?	Select Inspiratory Hold from Favorites	1	2	1	2	1	4	1	3	1	2	1	4	1	2
			8	498	13	269	12	334	14	265	10	361	12	353	12	291

Time

Sample of objective study results

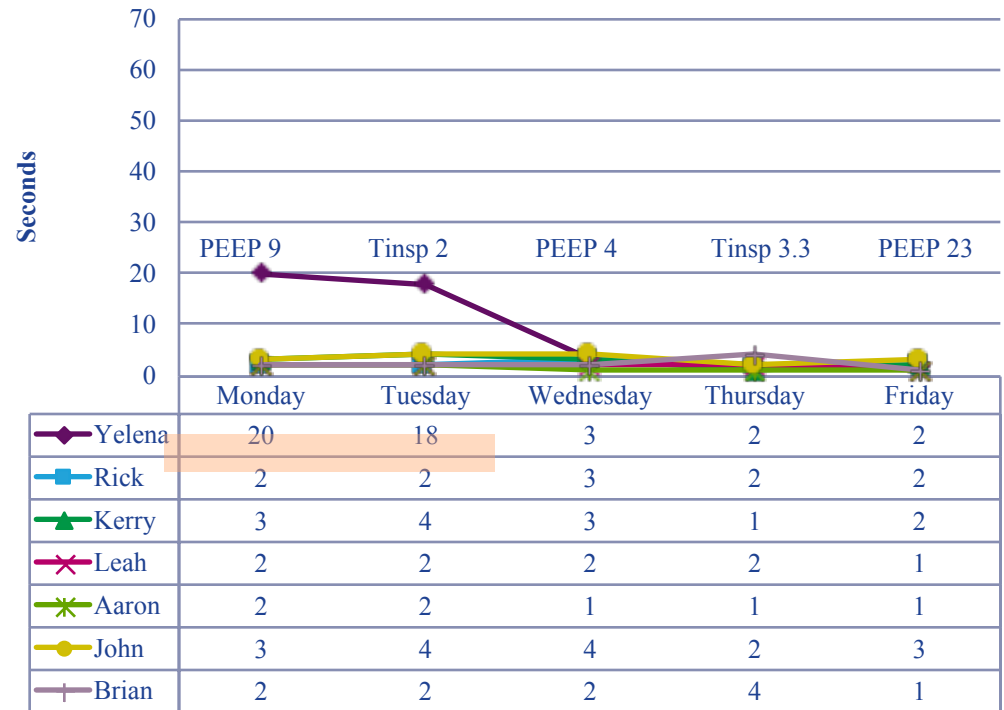


Users could perform some tasks from the beginning

Users easily remembered the “Quick Key”
The locations

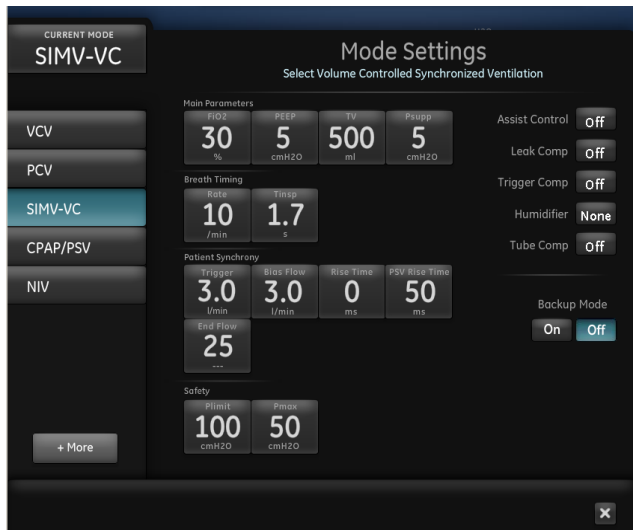


Task 1 - Quick Keys

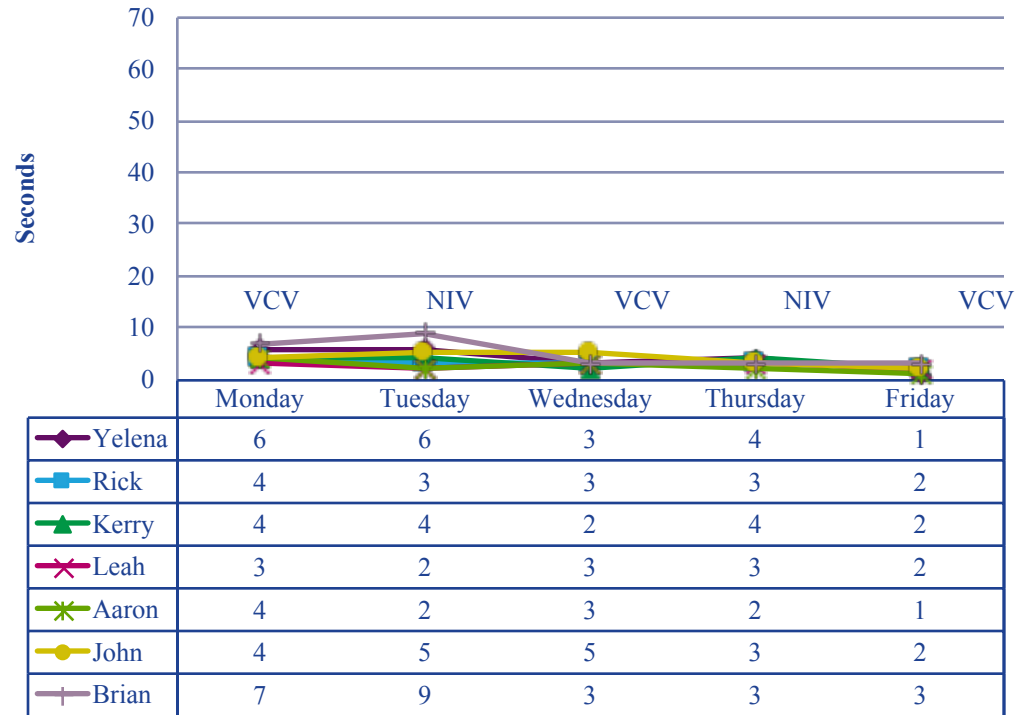


M + F P Value = 0.12035, which is > .05. Learning did not take place.
Alternatively, consistent efficient performance was the norm from the beginning

Change Mode is a routine behavior for Respiratory Therapists

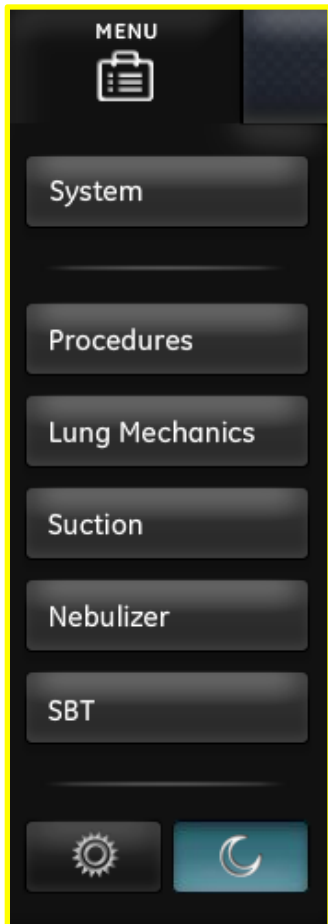


Task 2 - Change Mode



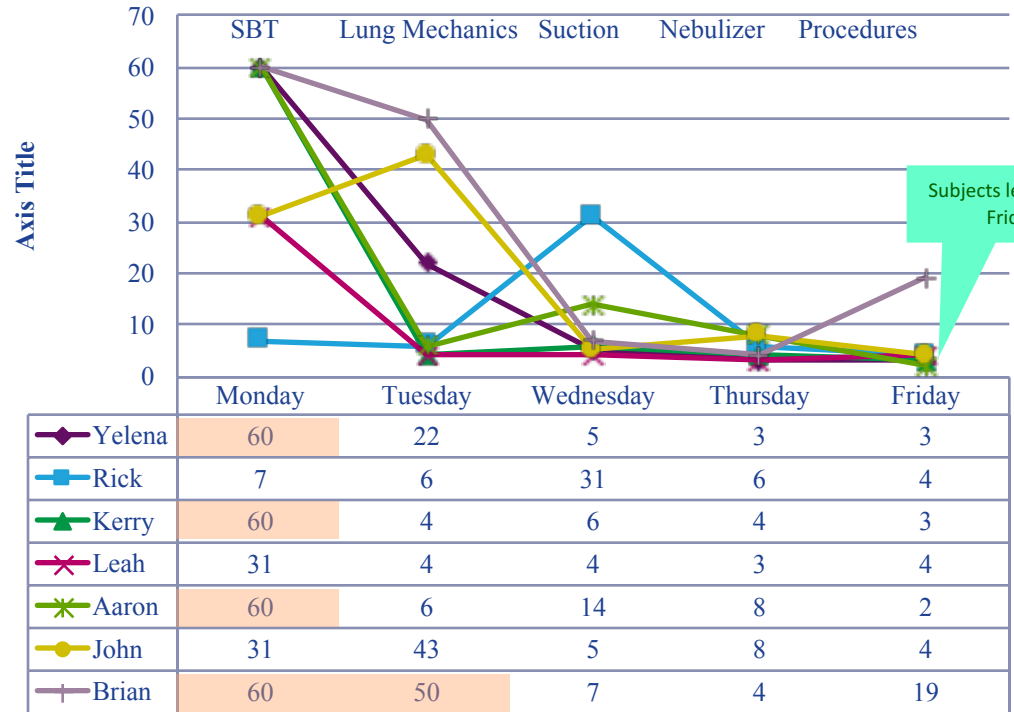
M + F T Test P Value = 0.000218, which is < .05. Learning did take place

Subjects learned Menu behavior by day 5

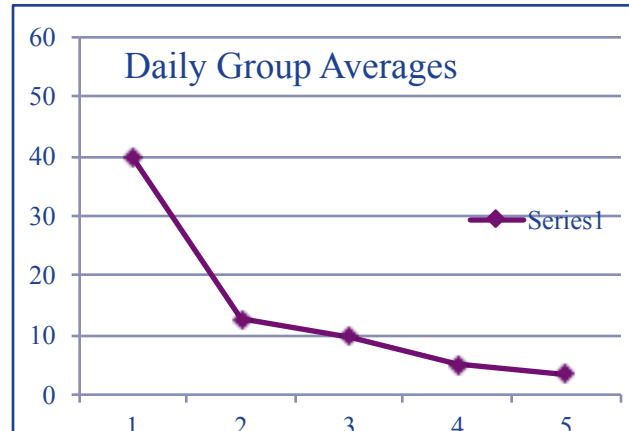


After the 5 days of practice, users were starting to remember and easily find the selections in the "Menu":

Task 3 - Menu Selection

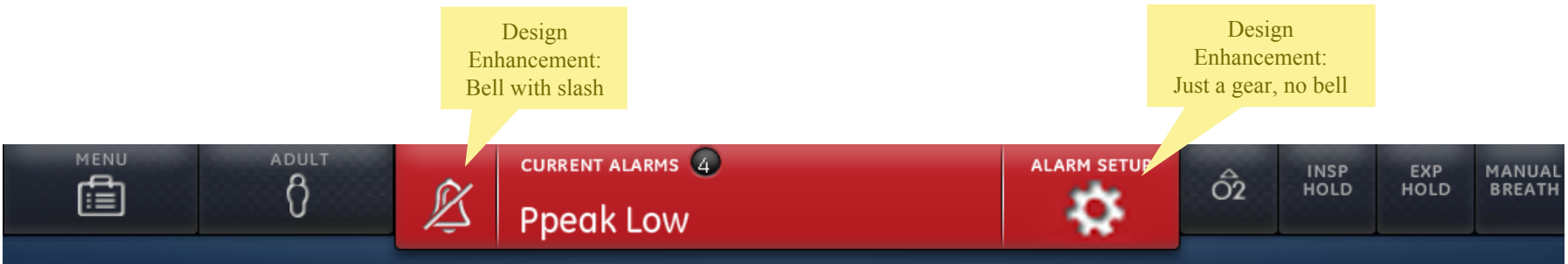
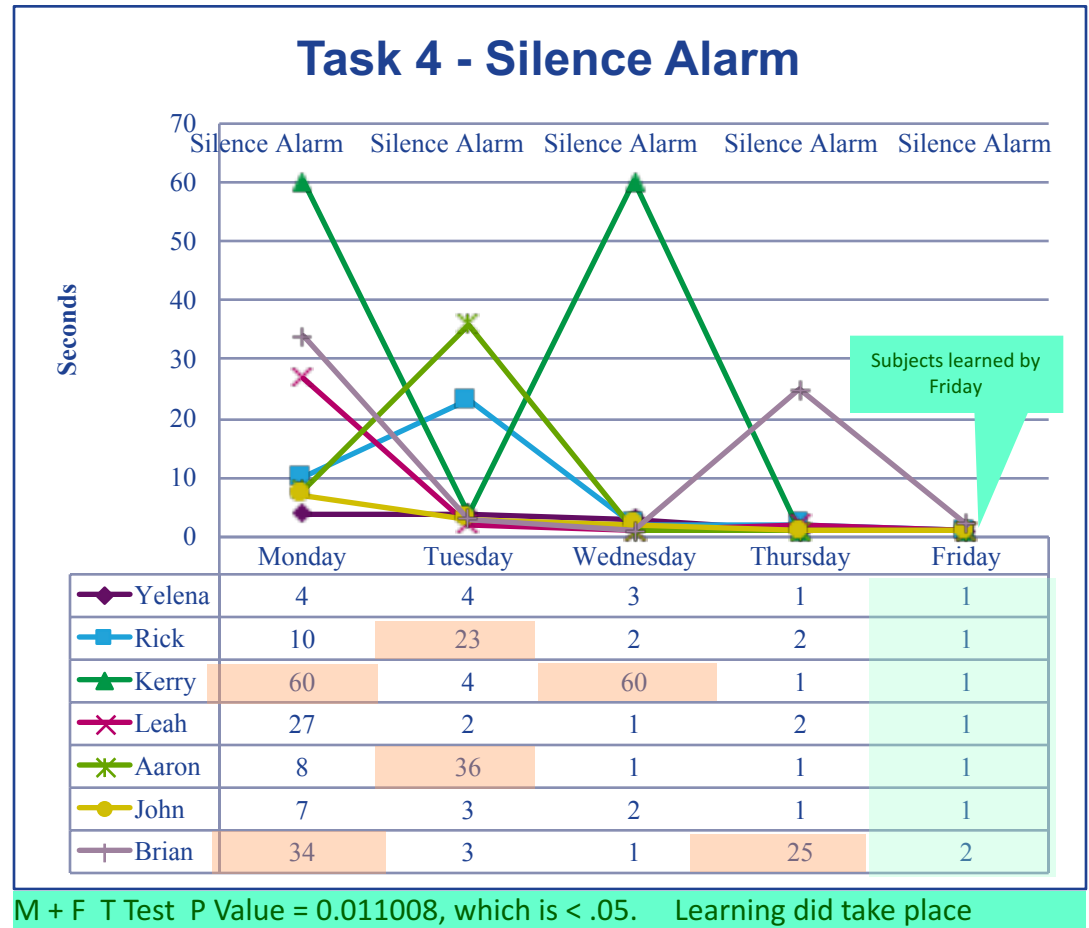


M + F T Test P Value = 0.000254, which is < .05. Learning did take place

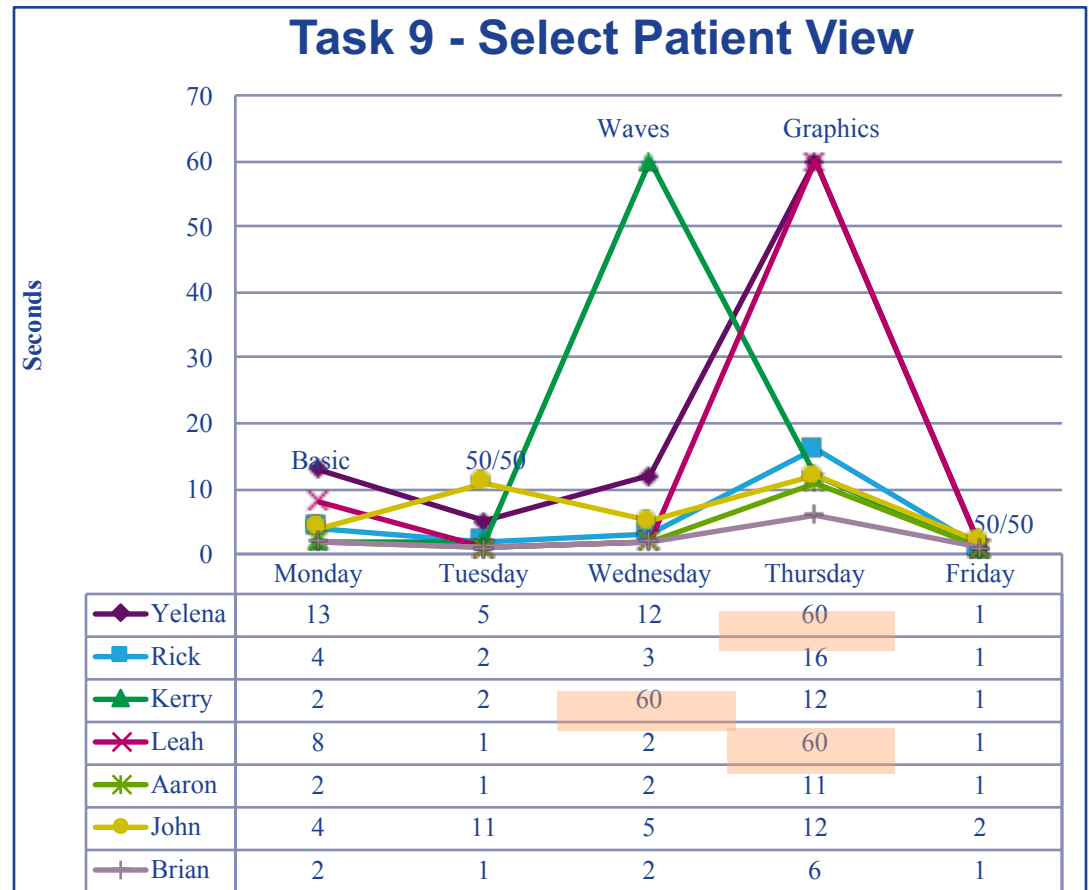
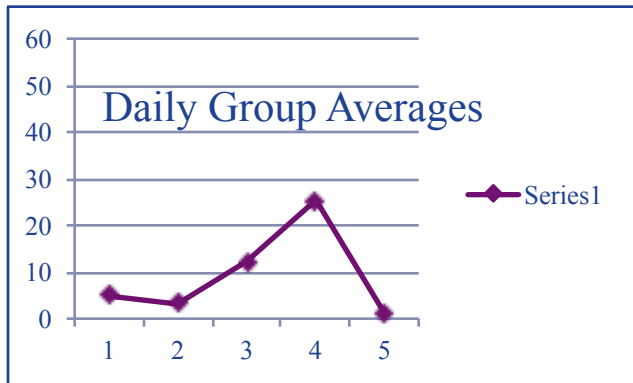


Subjects struggled with Alarm Silence - but learned it by day 5

Despite claims to the alternative, several users struggled to find “Alarm Silence” button the first several days. By Friday, all subjects had learned where the button was and how to push it



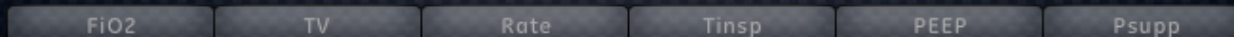
Users could not always remember the names of the primary navigation buttons



M + F T Test P Score = 0.014889, which is < .05. Learning did take place

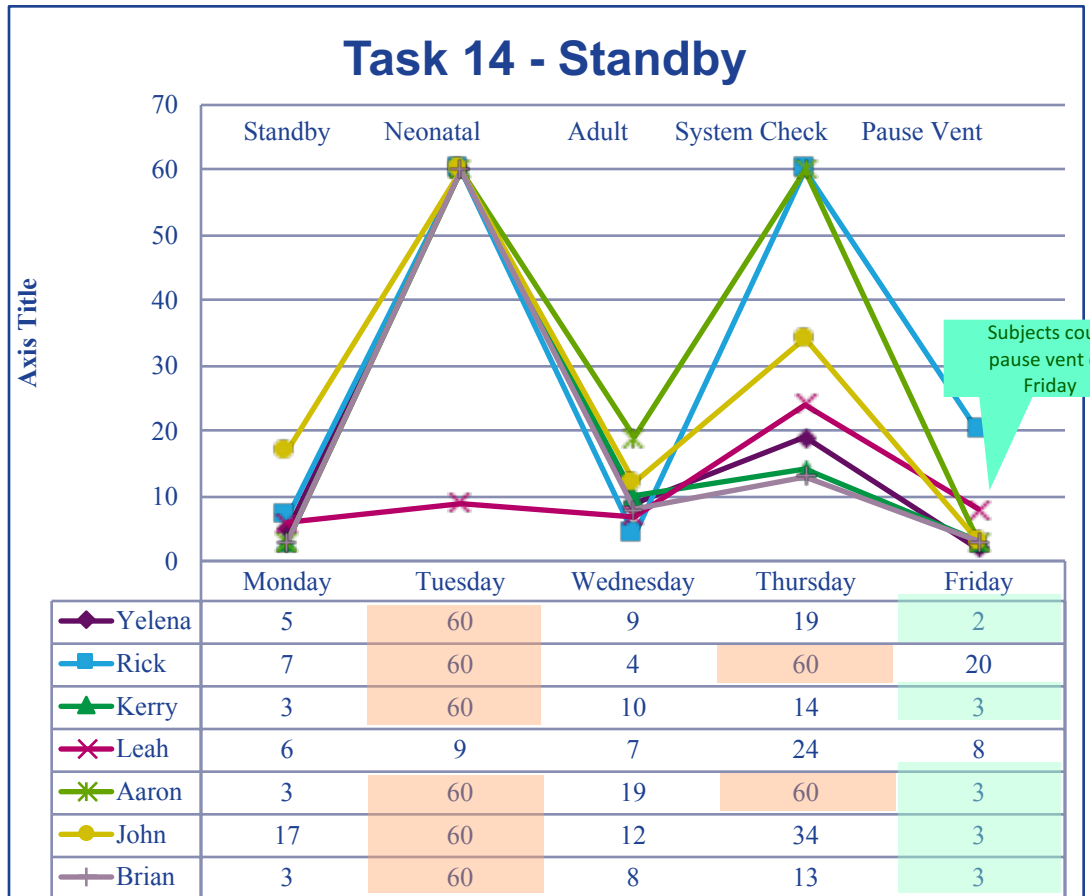
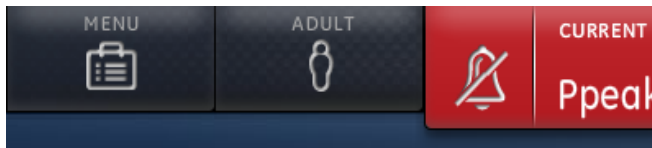
5 of 7 subjects agreed with the statement that the buttons should be labeled.

⚠ - Calibration Required



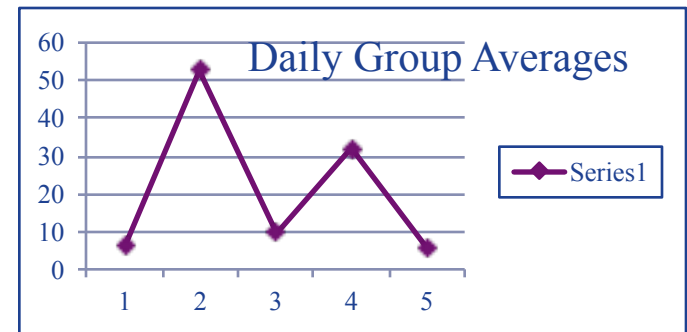
Users did not typically think to use “Standby” to change the system to “Neonatal” mode.

Many users thought this control was used to change patient type



Subjects could pause vent on Friday

M + F T Test P Value = 0.463946, which is > .05. Learning did not take place



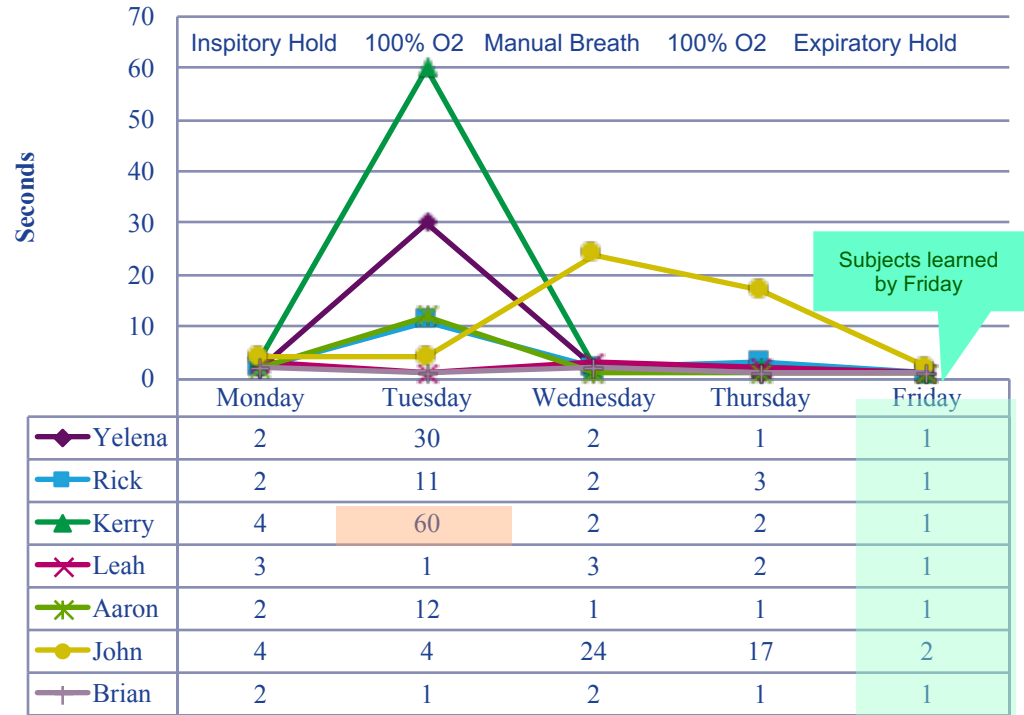
Subjects confused FIO2 with 100% O2 favorite key

Some users tried to use FIO2 Quick Key rather than the O2 Favorite key to change O2 to 100%.

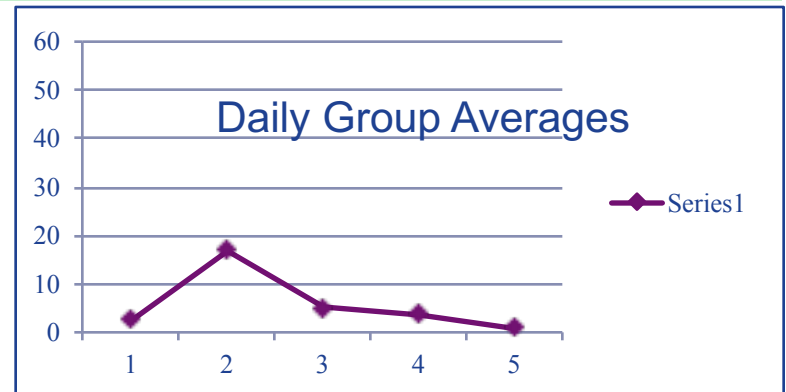
O2 Performance improved on Wednesday through Friday



Task 15 - Favorites



M + F T Test P Value = 0.000788, which is < .05. Learning did take place



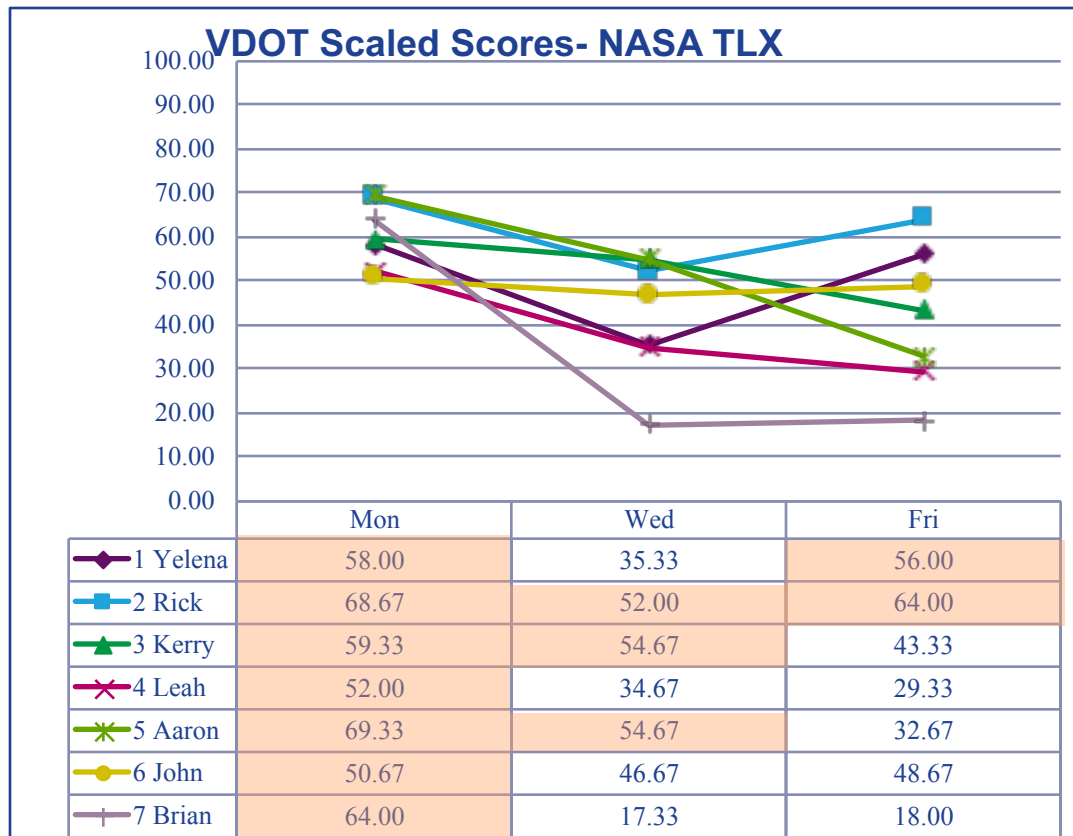
Subjective survey results



NASA TLX – Scores improved by day 5

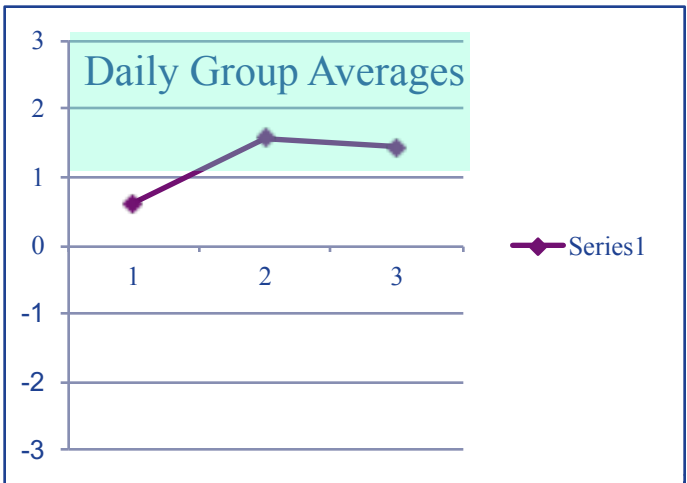
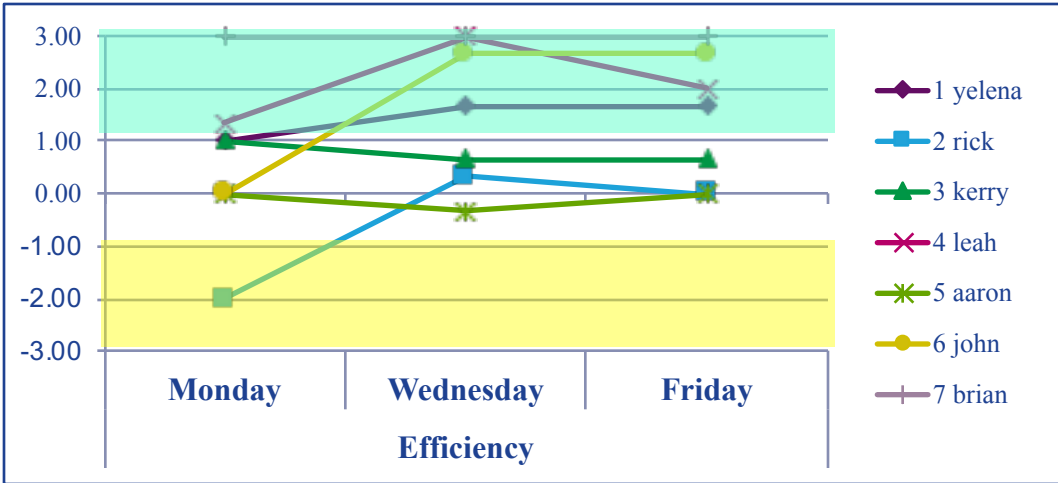
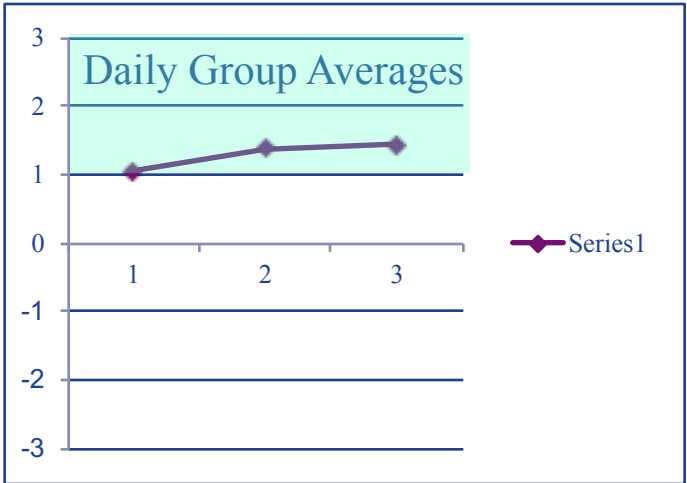
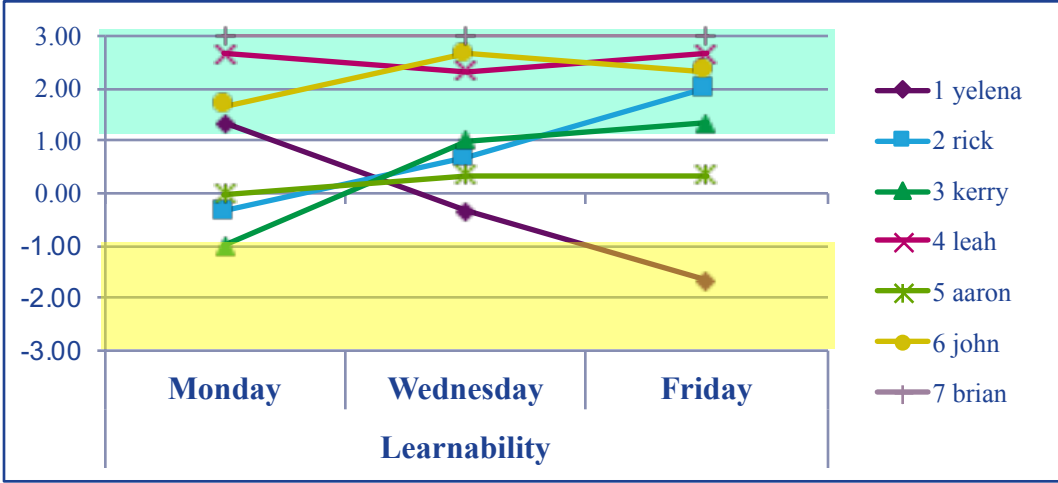
NASA-TLX is a multi-dimensional rating procedure that derives an overall workload score based on a weighted average of ratings on six subscales.

- Mental Demands,
- Physical Demands,
- Temporal Demands,
- Own Performance,
- Effort and
- Frustration.



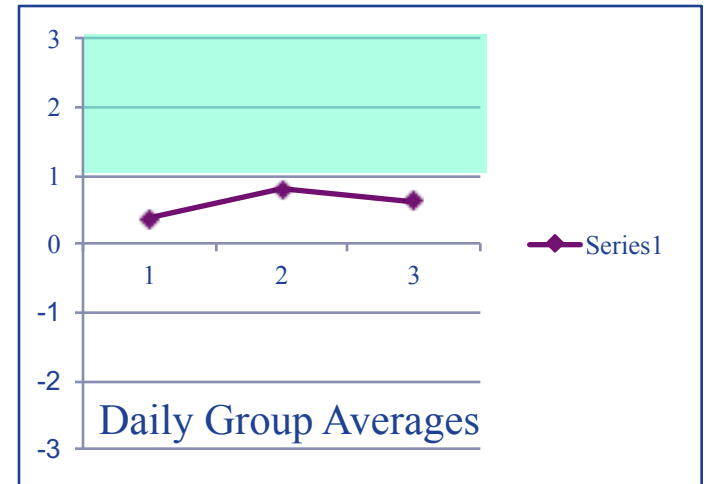
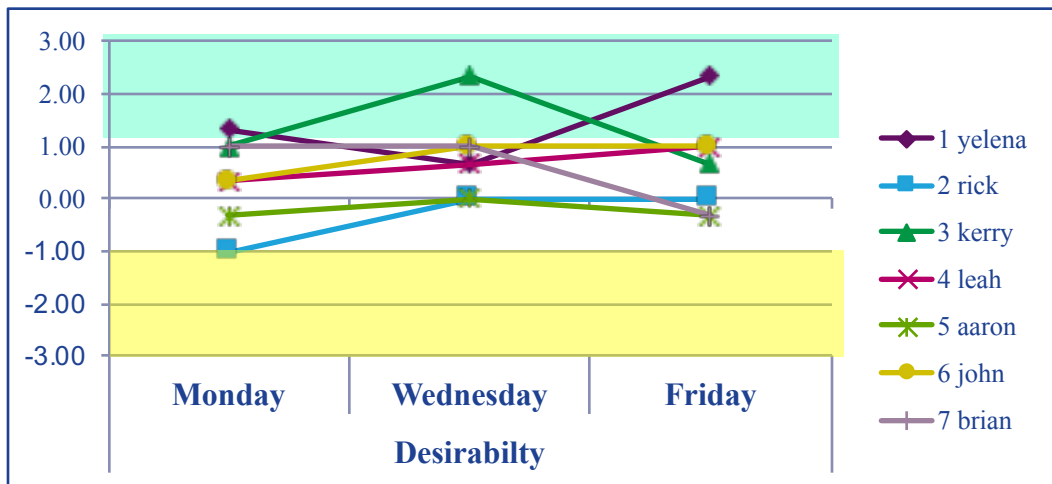
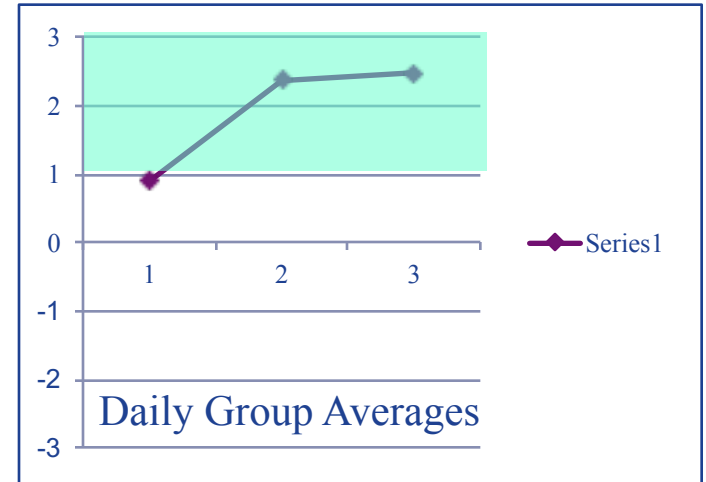
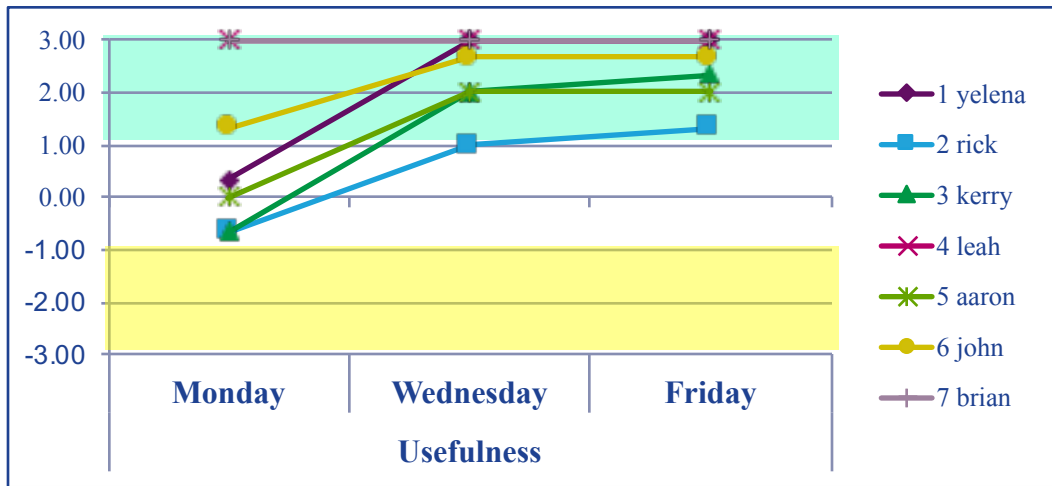
M + F T Test P Value = 0.008418, which is < .05. Subjects reported workload got easier

Learnability and Efficiency scores improved slightly



Usefulness took a jump

Desirability improved slightly



Standardized Usability Scores were average

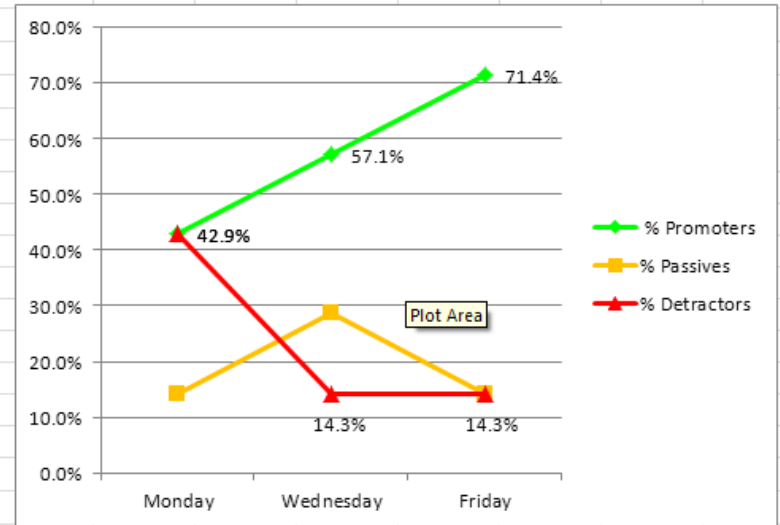


Net Promoter score improved from 0 to 57

Net Promoter Scores			
	Monday	Wednesday	Friday
5 aaron	10.00	10.00	10.00
7 brian	10.00	10.00	10.00
4 leah	9.00	9.00	9.00
1 yelena	8.00	8.00	8.00
3 kerry	6.00	8.00	9.00
6 john	6.00	9.00	9.00
2 rick	4.00	4.00	5.00
	Monday	Wednesday	Friday
% Promoters	42.9%	57.1%	71.4%
% Passives	14.3%	28.6%	14.3%
% Detractors	42.9%	14.3%	14.3%
	Monday	Wednesday	Friday
Net Promoter Score	0	42.8	57.1

Promoters (9-10)
 Passives (7-8)
 Detractors (0-6)

Percentage of Promoters, Passives, Detractors



The Percentage of Detractors (%De) is calculated by taking the total number of respondents who rate the product with a score of 6 or below and dividing by the total number of respondents.

Similarly, the Percentage of Passive (%Pa) is also calculated by taking the number of respondents who rate the product with a score of 7 or 8 and dividing by the total number of respondents.

The Percentage of Promoters (%Pr) is calculated by taking the number of respondents who rate the product with a score of 9 or 10 and dividing by the total number of respondents. The percentage of Detractors is then subtracted from the percentage of Promoters to obtain a Net Promoter Score (NPS).

VDOT - Net Promoter Score

