PSYC 8100: Exam 1

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Contents

1: NASA-TLX

1a) Data Analyses (R)

Load & Examine the dataset

```r
# Load the dataset
dat1 <- read.csv('Data/chemical.csv', header = T)

# Examine the data
str(dat1)
```

```
## 'data.frame':    25 obs. of  6 variables:
##  $ mental     : num  5.6 5.37 5.84 4.08 6.93 6.05 5.15 4.99 6 5.15 ...
##  $ physical   : num  5.87 5.26 4.97 3.25 5.52 5.11 4.47 4.53 4.75 5.09 ...
##  $ temporal   : num  6.19 5.56 6.67 5.21 5.49 5.32 5.56 5.1 5.36 5.2 ...
##  $ performance: num  6.16 5.26 6.04 5.36 5.35 5.84 6.96 4.51 6 4.87 ...
##  $ effort     : num  6.14 4.83 6.12 5.63 6.03 6.36 5.15 6.04 5.37 6.57 ...
##  $ frustration: num  5 5.99 4.99 3.73 5.03 4.55 5.65 4.84 5.08 4.67 ...
```

```r
summary(dat1)
```

```
##      mental         physical        temporal      performance        effort     
##  Min.   :4.08   Min.   :3.250   Min.   :4.210   Min.   :4.050   Min.   :4.280  
##  1st Qu.:5.04   1st Qu.:4.190   1st Qu.:5.200   1st Qu.:5.230   1st Qu.:5.120  
##  Median :5.47   Median :4.620   Median :5.550   Median :5.430   Median :5.430  
##  Mean   :5.45   Mean   :4.646   Mean   :5.603   Mean   :5.479   Mean   :5.503  
##  3rd Qu.:5.84   3rd Qu.:5.110   3rd Qu.:6.100   3rd Qu.:5.840   3rd Qu.:6.030  
##  Max.   :6.93   Max.   :5.870   Max.   :6.980   Max.   :6.960   Max.   :6.570  
##   frustration   
##  Min.   :3.430  
##  1st Qu.:4.030  
##  Median :4.700  
##  Mean   :4.602  
##  3rd Qu.:5.030  
##  Max.   :5.990
```

Conduct a Test

Now we will conduct a t-test to compare the sample mean from mental demand (5.45) with the sample mean from previous publishing involving normal workload (4.5).

```r
# Using the lsr package to find Cohen's d
library(lsr)

oneSampleTTest(dat1$mental, mu = 4.5)
```

```
## 
##    One sample t-test 
## 
## Data variable:   dat1$mental 
## 
## Descriptive statistics: 
##             mental
##    mean      5.450
##    std dev.  0.600
## 
```

```
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  7.916
##    degrees of freedom:  24
##    p-value:  <.001
##
## Other information:
##    two-sided 95% confidence interval:  [5.203, 5.698]
##    estimated effect size (Cohen's d):  1.583
```

Now we will conduct a t-test to compare the sample mean from physical demand (4.646) with the sample mean from previous publishing involving normal workload (4.5).

```r
oneSampleTTest(dat1$physical, mu = 4.5)
```

```
##
##    One sample t-test
##
## Data variable:   dat1$physical
##
## Descriptive statistics:
##             physical
##    mean        4.646
##    std dev.    0.668
##
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  1.092
##    degrees of freedom:  24
##    p-value:  0.286
##
## Other information:
##    two-sided 95% confidence interval:  [4.37, 4.922]
##    estimated effect size (Cohen's d):  0.218
```

Now we will conduct a t-test to compare the sample mean from temporal demand (5.60) with the sample mean from previous publishing involving normal workload (4.5).

```r
oneSampleTTest(dat1$temporal, mu = 4.5)
```

```
##
##    One sample t-test
##
## Data variable:   dat1$temporal
##
## Descriptive statistics:
```

```
##              temporal
##    mean        5.603
##    std dev.    0.745
##
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  7.4
##    degrees of freedom:  24
##    p-value:  <.001
##
## Other information:
##    two-sided 95% confidence interval:  [5.296, 5.911]
##    estimated effect size (Cohen's d):  1.48
```

Now we will conduct a t-test to compare the sample mean from performance (5.48) with the sample mean from previous publishing involving normal workload (4.5).

```
oneSampleTTest(dat1$performance, mu = 4.5)
```

```
##
##    One sample t-test
##
## Data variable:   dat1$performance
##
## Descriptive statistics:
##              performance
##    mean           5.479
##    std dev.       0.655
##
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  7.47
##    degrees of freedom:  24
##    p-value:  <.001
##
## Other information:
##    two-sided 95% confidence interval:  [5.209, 5.75]
##    estimated effect size (Cohen's d):  1.494
```

Now we will conduct a t-test to compare the sample mean from effort (5.50) with the sample mean from previous publishing involving normal workload (4.5).

```
oneSampleTTest(dat1$effort, mu = 4.5)
```

```
##
##    One sample t-test
```

```
##
## Data variable:   dat1$effort
##
## Descriptive statistics:
##             effort
##    mean      5.503
##    std dev.  0.572
##
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  8.771
##    degrees of freedom:  24
##    p-value:  <.001
##
## Other information:
##    two-sided 95% confidence interval:  [5.267, 5.739]
##    estimated effect size (Cohen's d):  1.754
```

Now we will conduct a t-test to compare the sample mean from frustration (4.60) with the sample mean from previous publishing involving normal workload (4.5).

```r
oneSampleTTest(dat1$frustration, mu = 4.5)
```

```
##
##    One sample t-test
##
## Data variable:   dat1$frustration
##
## Descriptive statistics:
##             frustration
##    mean           4.602
##    std dev.       0.698
##
## Hypotheses:
##    null:        population mean equals 4.5
##    alternative: population mean not equal to 4.5
##
## Test results:
##    t-statistic:  0.733
##    degrees of freedom:  24
##    p-value:  0.471
##
## Other information:
##    two-sided 95% confidence interval:  [4.314, 4.891]
##    estimated effect size (Cohen's d):  0.147
```

Assess Positive Association

Now, we will check for the possibility of positive association between mental, physical, and temporal demands.

```r
# Correlation between mental and physical
cor(dat1$mental, dat1$physical)
```

```
## [1] 0.4327571
```

```r
# Correlation between mental and temporal
cor(dat1$mental, dat1$temporal)
```

```
## [1] 0.01717709
```

```r
# Correlation between physical and temporal
cor(dat1$physical, dat1$temporal)
```

```
## [1] 0.2876702
```

1b) Summary of Analyses

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in mental demand and the sample mean from previous publishing involving normal workload. The average change in scoring was 5.45 (SD = 0.60). The test was statistically significant, $t(24) = 7.92$, $p <$ .001. This provides evidence that the NASA-TLX scores in mental demand went up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 1.583$.

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in physical demand and the sample mean from previous publishing involving normal workload. The average change in scoring was 4.65 (SD = 0.67). The test was not statistically significant, $t(24) = 1.09$, p = 0.29. This provides evidence that the NASA-TLX scores in physical demand did not go up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 0.218$.

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in temporal demand and the sample mean from previous publishing involving normal workload. The average change in scoring was 5.60 (SD = 0.75). The test was statistically significant, $t(24) = 7.40$, $p <$ .001. This provides evidence that the NASA-TLX scores in temporal demand went up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 1.48$.

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in performance and the sample mean from previous publishing involving normal workload. The average change in scoring was 5.48 (SD = 0.66). The test was statistically significant, $t(24) = 7.47$, $p <$ .001. This provides evidence that the NASA-TLX scores in performance went up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 1.49$.

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in effort and the sample mean from previous publishing involving normal workload. The average change in scoring was 5.50 (SD = 0.57). The test was statistically significant, $t(24) = 8.77$, $p <$ .001. This provides evidence that the NASA-TLX scores in effort went up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 1.75$.

A one sample t test was performed to evaluate whether there was a significant difference between NASA-TLX scores in frustration and the sample mean from previous publishing involving normal workload. The average change in scoring was 4.60 (SD = 0.70). The test was not statistically significant, $t(24) = 0.73$, $p =$ 0.47. This provides evidence that the NASA-TLX scores in frustration did not go up significantly with this simulation, compared to the sample mean from previous publishing. Cohen's $d = 0.15$.

These results provide evidence that four dimensions of the NASA-TLX (mental demand, temporal demand, performance, and effort) produce significantly higher workload than a normal workload, whereas two dimensions (physical demand and frustration) do not. Additionally, to investigate whether mental, physical and temporal demands were linearly related, we estimated the correlation between the three variables. Therefore, as mental demands increased, physical demands tended to increase ($r = 0.43$). Similarly, as mental demands increased, temporal demands also increased ($r = 0.02$). Additionally, as physical demands increased, temporal demands also increased ($r = 0.29$). These results indicate a positive relationship between all three dimensions.

2: Summer Youth Development Program

Data Analyses (SPSS)

See Attached Document (SPSS_01.png).

2a) Discuss any Validity Issues

Experimental designs provide stronger validity when the conditions are randomly assigned. This is because random assignment allows researchers to unambiguously interpret how and why the mean differences exist (or do not exist). Considering the participants in this study were not randomly assigned to their conditions, it leads to potential validity issues. Due to a number of potential confounding variables, it is difficult to understand why the differences in the two groups exist. For instance, does the socio-economic status and home life of the middle schoolers who did (or did not) participate in the summer program also have an impact on their levels of self-esteem and/or self-efficacy?

2b) Summary of Analyses

An independent samples t test was conducted to assess whether there is a difference on measures of self-esteem between middle schoolers who participate in a summer youth development program at Clemson University versus those who do not participate in the program. The average impact for those who did participate ($M = 4.87$, $SD = 1.09$) was less than that of those who did not participate ($M = 4.97$, $SD = 0.97$) and this difference was not statistically significant, $t(137) = 0.59$, $p = 0.58$. The 95% confidence interval for the mean difference was [-0.25, 0.44]. Cohen's $d = .095$.

An independent samples t test was conducted to assess whether there is a difference on measures of generalized self-efficacy between middle schoolers who participate in a summer youth development program at Clemson University versus those who do not participate in the program. The average impact for those who did participate ($M = 6.79$, $SD = 1.02$) was greater than that of those who did not participate ($M = 6.20$, $SD = 0.92$) and this difference was statistically significant, $t(137) = -3.62$, $p < .001$. The 95% confidence interval for the mean difference was [-0.92, -0.27]. Overall, participation in the program appears to be more effective at raising generalized self-efficacy levels than not participating. Cohen's $d = -0.62$.

3: CSSA Predicted Job Performance

3a) Data Analyses (R)

Load & Examine the Dataset

```r
# Load the dataset
dat3 <- read.csv('Data/valid.csv', header = T)

# Examine the data
str(dat3)
```

```
## 'data.frame':    184 obs. of  3 variables:
##  $ l.name: chr  "Tehero" "Pena" "Freyschlag" "Lewis" ...
##  $ cssa  : int  23 28 30 21 28 28 32 24 29 26 ...
##  $ perf  : int  34 37 42 27 34 32 36 37 32 30 ...
```

```r
summary(dat3)
```

```
##     l.name               cssa           perf      
##  Length:184         Min.   :13.0   Min.   :24.00  
##  Class :character   1st Qu.:23.0   1st Qu.:32.00  
##  Mode  :character   Median :25.0   Median :34.00  
##                     Mean   :25.1   Mean   :34.06  
##                     3rd Qu.:28.0   3rd Qu.:37.00  
##                     Max.   :36.0   Max.   :44.00
```

The mean of *cssa* and *perf* is 25.1 and 34.06, respectively.

Calculate the Prediction

```r
# Compute the correlation between CSSA scores and Performance levels.
cor(dat3$cssa, dat3$perf)
```

```
## [1] 0.5699847
```

```r
# Predict Job Performance using CSSA scores
pred <- lm(perf ~ cssa, data = dat3)
summary(pred)
```

```
## 
## Call:
## lm(formula = perf ~ cssa, data = dat3)
## 
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -7.4697 -1.9523 -0.1091  1.8735  7.8561 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) 20.63342    1.45219  14.208   <2e-16 ***
## cssa         0.53485    0.05715   9.359   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
```

```
## Residual standard error: 3.052 on 182 degrees of freedom
## Multiple R-squared:  0.3249, Adjusted R-squared:  0.3212
## F-statistic: 87.58 on 1 and 182 DF,  p-value: < 2.2e-16
```

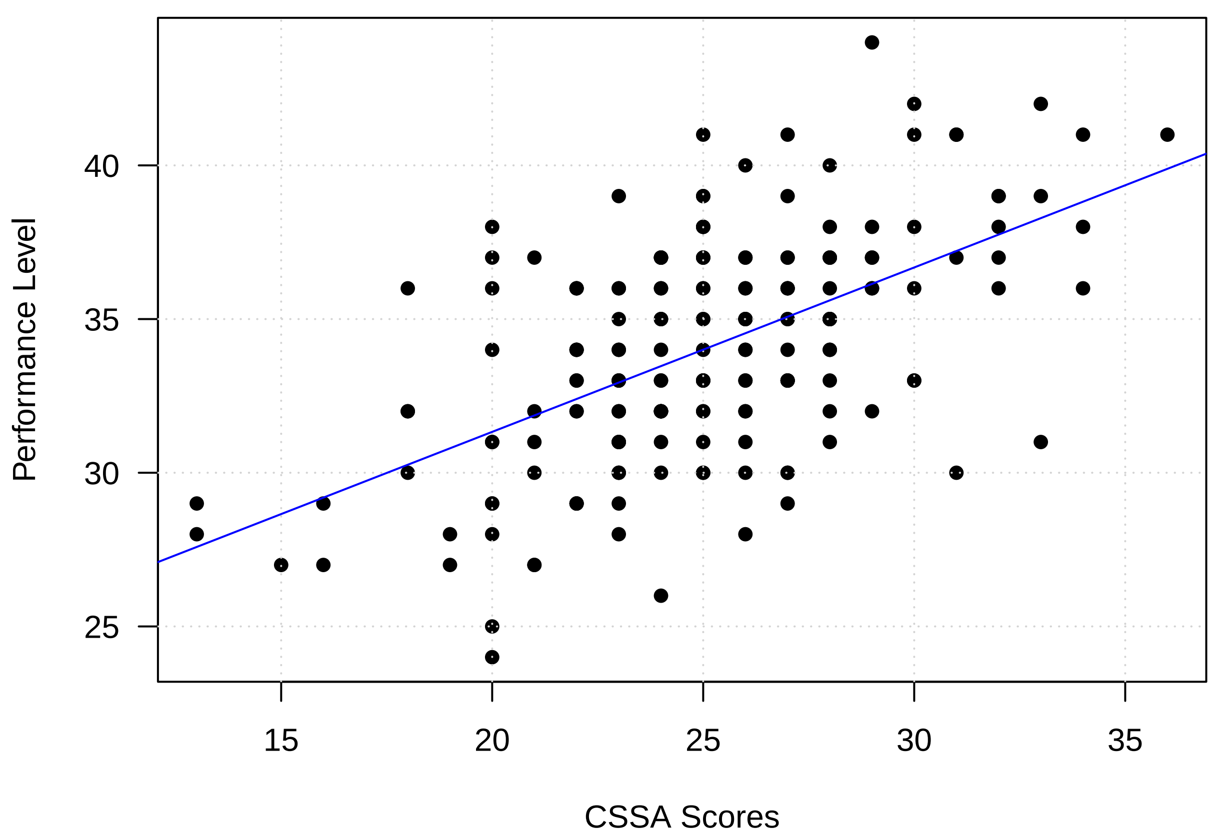
```
# Find the r-squared value
summary(pred)$r.squared
```

```
## [1] 0.3248825
```

```
# Interpret the regression slope.
pred$coefficients
```

```
## (Intercept)        cssa
##  20.6334230   0.5348452
```

```
# Plot the data
par(las = 1, mar = c(4.1, 4.1, 1.1, 1.1))
plot(dat3$cssa, dat3$perf,
pch = 16,
xlab = "CSSA Scores",
ylab = "Performance Level")
grid()
abline(a = pred$coefficients, col = "blue")
```



```r
# Predicted job performance if CSSA score = 10
predict(pred, new=list(cssa = 10))
```

```
##        1
## 25.98188
```

3b) Summary of Analyses

To investigate whether CSSA scores and performance levels were linearly related, we estimated the correlation between the two variables, $r = .57$. That is, as CSSA scores increased, performance levels tended to increase. To determine whether CSSA scores predict job performance, we conducted a simple linear regression where performance level regressed on CSSA scores. Results indicate that the model was statistically significant, F (182) = 87.58 ($p < .001$), with $r^2 = 0.32$. Based on our model, for every one-unit increase in CSSA scores, performance levels are expected to increase by 0.53 units ($B = .53$, $p < .001$). Additionally, we determined that a person's job performance would be 25.98, if their CSSA score was 10.

4: Training Program for Caregivers

4a) Data Analyses (by hand)

```r
# Compare whether there is a difference in the means between Control/Training groups on Patient Care
ctrl.mean <- 3.78
ctrl.sd <- 0.46
ctrl.n <- 40

cares.mean <- 4.20
cares.sd <- 0.51
cares.n <- 38

# Use the equation for a two-independent samples t-test
t.stat <- (cares.mean - ctrl.mean)/(sqrt((((cares.mean^2)/cares.n) + ((ctrl.mean^2)/ctrl.n))))
t.stat
```

```
## [1] 0.4634112
```

4b) Calculate Degrees of Freedom

```r
# Assume that our statistic is called stat
stat <- t.stat
abs(stat)
```

```
## [1] 0.4634112
```

```r
# Calculate the degrees of freedom
(df <- ctrl.n + cares.n - 2)
```

```
## [1] 76
```

```r
# Obtain the two-tailed p value
pt(abs(stat), df, lower.tail = F)*2
```

```
## [1] 0.6443941
```

4c) Summary of Analyses

An independent samples t test was conducted to assess whether there is a difference in patient care between the CARES training program for caregivers of dementia, and the control group. The average impact for those who completed the CARE program ($M = 4.20$, $SD = 0.51$) was more than that of those in the control group ($M = 3.78$, $SD = 0.46$) and this difference was not statistically significant, $t(76) = 0.46$, $p = 0.64$.