THE ASSIGGNMENT FIVE

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Question one

The hypotheses are

H1. ICT facilities have a positive effect on the ICT usage

H2. Perceived attributes have a positive effect on the ICT usage

H3. ICT facilities have a positive effect on the perceived attributes

Question two: Question 2: Assuming that Figure 1 is intended to be a path diagram, what is wrong with the paths?

If the Figure 1 is intended to be a path diagram, there is some worng. The wrong is that it does not contain arrow. Each arrow represents

regression. From the Figure 1, it is difficult to understand the regression. Also, as there is no arrow we can not identify what is

exogenous variable and what are endogenous variables. Also, there is another thing is that measurement errors for each indicator is not

indicated. The path diagram needs to be explained by the LISREL notaion which is standard to arrange the path diagram. Another wrong with

path is that there is no disturbances terms with the endogenous variables.

-0.5 we're also missing the variance of the exogenous variable

Question three: What is missing from Figure one: Be specific. (2 pts)

Some things are missing from Figure one. These are given below:

a. The arrow is missing. This arrow represents regression.
b. The measurement errors are missing from each indicator. These need to be indicated.
c. The disturbances terms are missing from each endogenous variables.
d. Becasue the arrow is missing, it is difficult to understand what is exogenous and what are endogenous varialbes.

-0.5 also missing is the variance for exogenous variable, ICT facilities

e. Indicators have variation themselves. This is not shown in Figure one

Question four: Are the data available in the paper to replicate Figure 1? (1 pt)

Yes, the data are available in the paper to replicate Figure one. Figure one will be explained by the Structural Equation Modeling.

Structural Equation Modeling is related to the analysis of covariance structure. In the paper, the covariance matrix is given and from that

AND we have the sample size, also necessary

we could replicate Figure 1.

Question five: What type of pattern coefficiencts (unstandardized or standardized) must be shown in Figure 2? How do you know?

Pattern coefficients must be standardized that will be shown in Figure 2. The pattern coefficents are unstandardized when the loading of

one indicator per factor is fixed to 1.0. From figure two, we have found that the loading of one indicator per factors is not fixed to one. This means that here the factor variance is fixed to one.

Question six: Read in the data and print it below. Note, that when you name the variables, they can't have spaces so either use abbreviated names or use a . or _ instead of a space. (2 pts)

```
library(lavaan)
```

```
## This is lavaan 0.6-3
```

```
## lavaan is BETA software! Please report any bugs.
```

```
lower= '
 1.59
 0.60 1.51
 0.45 0.22 1.29
 0.46 0.32 0.31 1.45
 0.14 0.19 0.20 0.19 0.58
 0.21 0.11 0.02 0.10 0.01 2.84
 0.54 0.32 0.20 0.19 0.02 2.35 3.53
 0.60 0.37 0.15 0.18 0.00 2.05 2.55 3.93
 0.29 0.25 0.35 0.14 0.14 1.36 1.60 1.59 4.44'

 beth = getCov(lower, names=c("ICTF","Lab","Ofice","RA","CO","EU","OB","IN","MA"))
 print(beth)
```

```
##       ICTF  Lab Ofice   RA   CO   EU   OB   IN   MA
## ICTF  1.59 0.60  0.45 0.46 0.14 0.21 0.54 0.60 0.29
## Lab   0.60 1.51  0.22 0.32 0.19 0.11 0.32 0.37 0.25
## Ofice 0.45 0.22  1.29 0.31 0.20 0.02 0.20 0.15 0.35
## RA    0.46 0.32  0.31 1.45 0.19 0.10 0.19 0.18 0.14
## CO    0.14 0.19  0.20 0.19 0.58 0.01 0.02 0.00 0.14
## EU    0.21 0.11  0.02 0.10 0.01 2.84 2.35 2.05 1.36
## OB    0.54 0.32  0.20 0.19 0.02 2.35 3.53 2.55 1.60
## IN    0.60 0.37  0.15 0.18 0.00 2.05 2.55 3.93 1.59
## MA    0.29 0.25  0.35 0.14 0.14 1.36 1.60 1.59 4.44
```

Question seven: Write and fit the model in Figure 2. Don’t forget to label the indirect effect. (1 pt)

```
library(lavaan)

mod <- '

# structural paths
ICT =~ ICTF +Lab+Ofice
PA =~ RA+CO+EU+OB
US =~ IN + MA
PA ~ a*ICT
US ~ b*ICT
US ~ c* PA


# indiect effects
ac := a*c
'
fit = sem(model = mod, sample.cov=beth, sample.nobs = 834)

summary(fit, fit.measures=TRUE,standardized=TRUE)
```

```
## lavaan 0.6-3 ended normally after 92 iterations
##
##   Optimization method                           NLMINB
##   Number of free parameters                         21
##
##   Number of observations                           834
##
##   Estimator                                         ML
##   Model Fit Test Statistic                     240.501
##   Degrees of freedom                                24
##   P-value (Chi-square)                           0.000
##
## Model test baseline model:
##
##   Minimum Function Test Statistic             1936.257
##   Degrees of freedom                                36
##   P-value                                        0.000
##
## User model versus baseline model:
##
##   Comparative Fit Index (CFI)                    0.886
##   Tucker-Lewis Index (TLI)                       0.829
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)             -12350.928
##   Loglikelihood unrestricted model (H1)     -12230.678
##
##   Number of free parameters                         21
##   Akaike (AIC)                               24743.856
##   Bayesian (BIC)                             24843.107
##   Sample-size adjusted Bayesian (BIC)        24776.418
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.104
##   90 Percent Confidence Interval          0.092  0.116
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.089
##
## Parameter Estimates:
##
##   Information                                 Expected
##   Information saturated (h1) model          Structured
##   Standard Errors                             Standard
```

```
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   ICT =~
##     ICTF             1.000                              1.065    0.845
##     Lab              0.530    0.079    6.669    0.000    0.564    0.459
##     Ofice            0.392    0.063    6.256    0.000    0.417    0.368
##   PA =~
##     RA               1.000                              0.109    0.090
##     CO               0.142    0.263    0.541    0.588    0.015    0.020
##     EU              12.641    5.125    2.466    0.014    1.373    0.815
##     OB              15.734    6.376    2.468    0.014    1.709    0.910
##   US =~
##     IN               1.000                              1.581    0.798
##     MA               0.635    0.049   12.895    0.000    1.004    0.477
##
## Regressions:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   PA ~
##     ICT        (a)    0.026    0.012    2.212    0.027    0.257    0.257
##   US ~
##     ICT        (b)    0.169    0.057    2.961    0.003    0.114    0.114
##     PA         (c)   13.312    5.406    2.463    0.014    0.914    0.914
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .ICTF              0.455    0.157    2.900    0.004    0.455    0.286
##    .Lab               1.190    0.074   16.183    0.000    1.190    0.789
##    .Ofice             1.114    0.060   18.456    0.000    1.114    0.865
##    .RA                1.436    0.070   20.400    0.000    1.436    0.992
##    .CO                0.579    0.028   20.420    0.000    0.579    1.000
##    .EU                0.952    0.068   13.981    0.000    0.952    0.336
##    .OB                0.606    0.082    7.354    0.000    0.606    0.172
##    .IN                1.425    0.165    8.632    0.000    1.425    0.363
##    .MA                3.426    0.178   19.216    0.000    3.426    0.773
##     ICT               1.133    0.172    6.585    0.000    1.000    1.000
##    .PA                0.011    0.009    1.234    0.217    0.934    0.934
##    .US                0.244    0.154    1.589    0.112    0.098    0.098
##
## Defined Parameters:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##     ac                0.349    0.071    4.915    0.000    0.235    0.235
```

```
anova(fit)
```

```
## Chi Square Test Statistic (unscaled)
##
##           Df   AIC   BIC Chisq Chisq diff Df diff Pr(>Chisq)
## Saturated  0               0.0
## Model     24 24744 24843 240.5      240.5      24  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Question 8: Report and interpret the chi-square test of model fit and the standard fit statistics (CFI, TLI, RMSEA, SRMR) (i.e., is this an acceptable model?). Do these match the values reported by the authors? (3 pts)

THe Chi-square test of model fit is 240.5. The CFI value is 0.886 and the TLI is 0.829. The RMSEA is 0.104 and SRMR is 0.089. The values do not match with the values reported by the authors. The value for CFI and TLI greater than 0.8 which indicates a good fit. RMSEA less than 0.06 or 0.08 are considered indicators of good fit. However, here, the RMSEA value is 0.104 which is greater than 0.06 or 0.08 which does not indicate a good fit. The SRMR value less than 0.1 indicates a good fit and the value of our result is 0.089. Also, the Chi-Square /degrees of freedom value should be 3 or less than 3. BUt in our analysis, this value is greater than 3. Overall, all values indicate that the model does not seem acceptable because the RMSEA value and chis-sq/df do not make a good fit.

-1 0.8 is way too generous for "good fit" on CFI/TLI -- even the authors mention 0.95. As Kline notes, chisq/df is a bad measure, and you never interpreted the actual chi-square test

Question 9: Do your estimated parameters (either loadings or structural parameters) match those report in Figure 2? Do all the indicators load onto their respective factors? Which ones don't? (2 pt)

No, my estimated parameters (either loadings or structual parameters) do not match those report with repect to figure one. Although my hypotheses are statistically significant, the value of the regression coefficient, factor loadings, and measurement errors are different. Yes, all the indicators load onto their respective factors. For example, ICT facilities include ICTF in classroom, lab and office. These has been loaded. Also, the indicators for perceived attributes and the indicators for ICT usage are also loaded based on their respective factors.

-1 There is very little evidence that compatibility and relative advantage load onto their respective factors.

Question 10: Using your results, and Kline's recommendations, are the indicators a good reflection of the underlying constructs? Which ones are and which ones aren't? (2 pt)

Based on my results and Kline's recommendations, there are some indicators that are a good reflection of the underlying constructs. For example, based on Kline, if the factor loading value is greater than 0.7 then those indicators are a good reflection of the underlying constructs. ICT facilities include three

indicators that are ICTF in classroom, lab, and office. Here, ICTF in classroom is a good indicator becase the factor loading value is greater than 0.7. However, ICTF in lab and office indicators are not a good reflecetion of the underlyign constructs because their values are less than 0.5. The ICT usae include instructional and managerial. THe factor loading for industrial is greater than 0.7 which is a good reflection ofthe underlying construct. However, managerial is not a good indicator becuse the factor loading value is only 0.477 altohgts reasonalbe to choose. The Perceived attributes include four indicators and they are relative advantage, compatibility, ease of use, and observability. The factor loading for Relative advantage and compatibility are very low and they are not a good reflection of the underlying constructs but the factor loading for ease of use and observability are very high and they are a good reflection of the underlying constructs.

Question 11: Report your r-squared for ICT usage. Does it match the results reported in Figure 2 (1 pt)

```
inspect(fit, what="r2")
```

```
##  ICTF   Lab Ofice    RA    CO    EU    OB    IN    MA    PA    US
## 0.714 0.211 0.135 0.008 0.000 0.664 0.828 0.637 0.227 0.066 0.902
```

The value for the r-squared for ICT usage is 90.2%. It does not match the reports reported in Figure 2.

Question 12: If your found that your results didn't match the paper's findings. Why do you think this could be? Give two reasons (2 pt)

My results did not match the paper's findings. I think there are some important reasons. One of the important reason is that we do not have the raw data for the analysis. We just used the covariance matrix from paper. It is still importatnt to use the raw data for the analsis. This may be one of the reason. Another important reason is that there is some error with the standard deviation. For example, some sd's are 1684, 1878. These might have some wrong with the covariance matrix. Because if we take the square of the SD it should match with the covarialnce value given at the last of each row.But the value did not match with the last value of the covarianve matrix. Therefore, the author did some wrong with the standard deviation and covariance matrix value. These are the reasons I think my results did not match the paper's findings.

Question thirteen: Are your conclusions about the hypotheses qualitatively the same as the authors? (1 pt)

Yes, my conclusions about the hypotheses are qualitaitively the same as the authors because from my conclusions are hypotheses are statistically significant because the p value is less than 0.05

Question fourteen: Please report the size of your indirect effect, assuming that it's significant based on a bootstrap (*which you do not need to do*), would you have complete or partial mediation?

The size of the indirect effect is 0.235 (standardized). I have found the partial mediation because ICA facilities have a direct and significant effect on ICT usage.