SEM Analysis : Influence of player Traits on Flow in Virtual Reality

SEM for Traits using Lavaan

Traits Model

```
## lavaan 0.6-9 ended normally after 45 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                        60
##
##   Number of observations                            36
##
## Model Test User Model:
##
##   Test statistic                               549.316
##   Degrees of freedom                               265
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                               878.146
##   Degrees of freedom                               300
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.508
##   Tucker-Lewis Index (TLI)                       0.443
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -1394.491
##   Loglikelihood unrestricted model (H1)      -1119.833
##
##   Akaike (AIC)                                2908.982
##   Bayesian (BIC)                              3003.993
##   Sample-size adjusted Bayesian (BIC)         2816.554
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.173
##   90 Percent confidence interval - lower         0.152
##   90 Percent confidence interval - upper         0.193
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.130
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Expected
##   Information saturated (h1) model          Structured
```

```
## 
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)  Std.lv  Std.all
##   Aesthetic =~
##     AEST1            1.000                                0.888    0.794
##     AEST2            0.593    0.223    2.663    0.008     0.526    0.525
##     AEST3            0.393    0.229    1.716    0.086     0.349    0.328
##     AEST4            0.384    0.321    1.198    0.231     0.341    0.227
##     AEST5            0.629    0.282    2.230    0.026     0.559    0.432
##   Challenge =~
##     CHAL1            1.000                                1.085    0.754
##     CHAL2            0.875    0.282    3.101    0.002     0.950    0.534
##     CHAL3            0.738    0.152    4.852    0.000     0.801    0.812
##     CHAL4            1.048    0.209    5.005    0.000     1.137    0.838
##     CHAL5            0.948    0.196    4.829    0.000     1.029    0.809
##   Goals =~
##     GOAL1            1.000                                1.058    0.527
##     GOAL2            0.624    0.292    2.142    0.032     0.661    0.461
##     GOAL3            0.952    0.341    2.793    0.005     1.007    0.709
##     GOAL4            1.441    0.491    2.937    0.003     1.525    0.819
##     GOAL5            0.693    0.271    2.559    0.010     0.733    0.603
##   Narrative =~
##     NARR1            1.000                                0.984    0.760
##     NARR2            0.668    0.180    3.715    0.000     0.657    0.669
##     NARR3            1.177    0.281    4.188    0.000     1.158    0.763
##     NARR4            0.848    0.237    3.574    0.000     0.834    0.643
##     NARR5            0.630    0.214    2.941    0.003     0.620    0.530
##   Social =~
##     SOCI1            1.000                                1.000    0.768
##     SOCI2            1.169    0.249    4.696    0.000     1.169    0.744
##     SOCI3            1.236    0.228    5.429    0.000     1.237    0.839
##     SOCI4            1.646    0.268    6.132    0.000     1.646    0.944
##     SOCI5            1.030    0.287    3.593    0.000     1.030    0.588
## 
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)  Std.lv  Std.all
##   Aesthetic ~~
##     Challenge        0.267    0.212    1.261    0.207     0.277    0.277
##     Goals            0.046    0.206    0.223    0.824     0.049    0.049
##     Narrative        0.511    0.225    2.269    0.023     0.586    0.586
##     Social           0.551    0.223    2.466    0.014     0.621    0.621
##   Challenge ~~
##     Goals            0.514    0.293    1.752    0.080     0.448    0.448
##     Narrative        0.261    0.219    1.194    0.233     0.245    0.245
##     Social           0.137    0.202    0.678    0.497     0.126    0.126
##   Goals ~~
##     Narrative        0.338    0.245    1.377    0.169     0.324    0.324
##     Social          -0.178    0.213   -0.835    0.403    -0.168   -0.168
##   Narrative ~~
##     Social           0.313    0.204    1.535    0.125     0.318    0.318
## 
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)  Std.lv  Std.all
##    .AEST1            0.462    0.228    2.021    0.043     0.462    0.369
##    .AEST2            0.729    0.193    3.769    0.000     0.729    0.725
##    .AEST3            1.010    0.247    4.097    0.000     1.010    0.892
##    .AEST4            2.131    0.510    4.177    0.000     2.131    0.948
##    .AEST5            1.361    0.343    3.963    0.000     1.361    0.813
##    .CHAL1            0.893    0.252    3.540    0.000     0.893    0.431
##    .CHAL2            2.262    0.561    4.034    0.000     2.262    0.715
##    .CHAL3            0.330    0.103    3.196    0.001     0.330    0.340
##    .CHAL4            0.548    0.185    2.970    0.003     0.548    0.298
##    .CHAL5            0.561    0.174    3.225    0.001     0.561    0.346
##    .GOAL1            2.907    0.748    3.886    0.000     2.907    0.722
##    .GOAL2            1.616    0.405    3.995    0.000     1.616    0.787
```

```
##     .GOAL3            1.006    0.309    3.259    0.001    1.006    0.498
##     .GOAL4            1.139    0.490    2.325    0.020    1.139    0.329
##     .GOAL5            0.941    0.254    3.706    0.000    0.941    0.636
##     .NARR1            0.707    0.230    3.081    0.002    0.707    0.422
##     .NARR2            0.533    0.150    3.562    0.000    0.533    0.553
##     .NARR3            0.964    0.315    3.062    0.002    0.964    0.418
##     .NARR4            0.986    0.270    3.651    0.000    0.986    0.586
##     .NARR5            0.983    0.251    3.918    0.000    0.983    0.719
##     .SOCI1            0.694    0.184    3.767    0.000    0.694    0.410
##     .SOCI2            1.105    0.288    3.840    0.000    1.105    0.447
##     .SOCI3            0.644    0.189    3.400    0.001    0.644    0.296
##     .SOCI4            0.333    0.195    1.706    0.088    0.333    0.110
##     .SOCI5            2.003    0.491    4.079    0.000    2.003    0.654
##      Aesthetic        0.788    0.339    2.321    0.020    1.000    1.000
##      Challenge        1.178    0.462    2.550    0.011    1.000    1.000
##      Goals            1.120    0.722    1.550    0.121    1.000    1.000
##      Narrative        0.968    0.391    2.474    0.013    1.000    1.000
##      Social           1.000    0.374    2.674    0.008    1.000    1.000
```

Adjusted Traits Models

Adjusted on Aesthetic   Adjustment : Remove AEST4

```
## lavaan 0.6-9 ended normally after 43 iterations
##
##     Estimator                                         ML
##     Optimization method                           NLMINB
##     Number of model parameters                        58
##
##     Number of observations                            36
##
## Model Test User Model:
##
##     Test statistic                               520.777
##     Degrees of freedom                               242
##     P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##     Test statistic                               848.226
##     Degrees of freedom                               276
##     P-value                                        0.000
##
## User Model versus Baseline Model:
##
##     Comparative Fit Index (CFI)                    0.513
##     Tucker-Lewis Index (TLI)                       0.444
##
## Loglikelihood and Information Criteria:
##
##     Loglikelihood user model (H0)              -1329.528
##     Loglikelihood unrestricted model (H1)      -1069.140
##
##     Akaike (AIC)                                2775.056
##     Bayesian (BIC)                              2866.900
##     Sample-size adjusted Bayesian (BIC)         2685.709
##
## Root Mean Square Error of Approximation:
##
##     RMSEA                                          0.179
##     90 Percent confidence interval - lower         0.158
##     90 Percent confidence interval - upper         0.200
##     P-value RMSEA <= 0.05                          0.000
##
```

```
## Standardized Root Mean Square Residual:
##
##    SRMR                                            0.129
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Expected
##    Information saturated (h1) model          Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    Aesthetic =~
##      AEST1            1.000                                0.912    0.816
##      AEST2            0.555    0.215    2.574    0.010     0.506    0.504
##      AEST3            0.370    0.222    1.665    0.096     0.337    0.317
##      AEST5            0.571    0.273    2.092    0.036     0.520    0.402
##    Challenge =~
##      CHAL1            1.000                                1.085    0.754
##      CHAL2            0.876    0.282    3.103    0.002     0.950    0.534
##      CHAL3            0.738    0.152    4.848    0.000     0.800    0.812
##      CHAL4            1.048    0.210    5.004    0.000     1.137    0.838
##      CHAL5            0.949    0.196    4.830    0.000     1.030    0.809
##    Goals =~
##      GOAL1            1.000                                1.057    0.527
##      GOAL2            0.625    0.292    2.143    0.032     0.661    0.461
##      GOAL3            0.953    0.341    2.792    0.005     1.007    0.709
##      GOAL4            1.443    0.492    2.936    0.003     1.526    0.820
##      GOAL5            0.693    0.271    2.556    0.011     0.732    0.602
##    Narrative =~
##      NARR1            1.000                                0.986    0.762
##      NARR2            0.661    0.179    3.694    0.000     0.652    0.663
##      NARR3            1.181    0.280    4.221    0.000     1.164    0.767
##      NARR4            0.848    0.236    3.589    0.000     0.836    0.644
##      NARR5            0.624    0.213    2.923    0.003     0.615    0.526
##    Social =~
##      SOCI1            1.000                                1.001    0.769
##      SOCI2            1.170    0.249    4.701    0.000     1.170    0.744
##      SOCI3            1.238    0.228    5.441    0.000     1.239    0.840
##      SOCI4            1.643    0.268    6.130    0.000     1.644    0.942
##      SOCI5            1.027    0.287    3.586    0.000     1.028    0.587
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    Aesthetic ~~
##      Challenge        0.255    0.214    1.191    0.234     0.258    0.258
##      Goals            0.028    0.210    0.134    0.893     0.029    0.029
##      Narrative        0.526    0.229    2.298    0.022     0.585    0.585
##      Social           0.581    0.228    2.545    0.011     0.637    0.637
##    Challenge ~~
##      Goals            0.513    0.293    1.752    0.080     0.447    0.447
##      Narrative        0.261    0.219    1.190    0.234     0.244    0.244
##      Social           0.137    0.202    0.678    0.498     0.126    0.126
##    Goals ~~
##      Narrative        0.340    0.246    1.384    0.166     0.326    0.326
##      Social          -0.178    0.213   -0.836    0.403    -0.168   -0.168
##    Narrative ~~
##      Social           0.314    0.204    1.536    0.124     0.318    0.318
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##     .AEST1            0.418    0.240    1.743    0.081     0.418    0.334
##     .AEST2            0.750    0.196    3.835    0.000     0.750    0.746
##     .AEST3            1.018    0.247    4.115    0.000     1.018    0.900
##     .AEST5            1.402    0.349    4.018    0.000     1.402    0.838
```

```
##      .CHAL1            0.894    0.252    3.540    0.000    0.894    0.432
##      .CHAL2            2.261    0.560    4.034    0.000    2.261    0.715
##      .CHAL3            0.331    0.103    3.200    0.001    0.331    0.341
##      .CHAL4            0.548    0.185    2.968    0.003    0.548    0.298
##      .CHAL5            0.559    0.174    3.221    0.001    0.559    0.345
##      .GOAL1            2.909    0.748    3.888    0.000    2.909    0.722
##      .GOAL2            1.615    0.404    3.995    0.000    1.615    0.787
##      .GOAL3            1.006    0.309    3.261    0.001    1.006    0.498
##      .GOAL4            1.136    0.490    2.321    0.020    1.136    0.328
##      .GOAL5            0.942    0.254    3.709    0.000    0.942    0.637
##      .NARR1            0.704    0.229    3.076    0.002    0.704    0.420
##      .NARR2            0.541    0.151    3.587    0.000    0.541    0.560
##      .NARR3            0.950    0.313    3.038    0.002    0.950    0.412
##      .NARR4            0.984    0.269    3.651    0.000    0.984    0.585
##      .NARR5            0.989    0.252    3.927    0.000    0.989    0.723
##      .SOCI1            0.693    0.184    3.763    0.000    0.693    0.409
##      .SOCI2            1.102    0.287    3.836    0.000    1.102    0.446
##      .SOCI3            0.639    0.188    3.388    0.001    0.639    0.294
##      .SOCI4            0.341    0.196    1.746    0.081    0.341    0.112
##      .SOCI5            2.007    0.492    4.078    0.000    2.007    0.655
##       Aesthetic        0.831    0.353    2.354    0.019    1.000    1.000
##       Challenge        1.177    0.462    2.549    0.011    1.000    1.000
##       Goals            1.118    0.722    1.550    0.121    1.000    1.000
##       Narrative        0.972    0.391    2.482    0.013    1.000    1.000
##       Social           1.001    0.374    2.675    0.007    1.000    1.000
```

Adjustment : Remove AEST3, AEST4

```
## lavaan 0.6-9 ended normally after 43 iterations
##
##     Estimator                                         ML
##     Optimization method                           NLMINB
##     Number of model parameters                        56
##
##     Number of observations                            36
##
## Model Test User Model:
##
##     Test statistic                               468.464
##     Degrees of freedom                               220
##     P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##     Test statistic                               793.069
##     Degrees of freedom                               253
##     P-value                                        0.000
##
## User Model versus Baseline Model:
##
##     Comparative Fit Index (CFI)                    0.540
##     Tucker-Lewis Index (TLI)                       0.471
##
## Loglikelihood and Information Criteria:
##
##     Loglikelihood user model (H0)              -1277.638
##     Loglikelihood unrestricted model (H1)      -1043.406
##
##     Akaike (AIC)                                2667.276
##     Bayesian (BIC)                              2755.953
##     Sample-size adjusted Bayesian (BIC)         2581.009
##
## Root Mean Square Error of Approximation:
##
##     RMSEA                                          0.177
```

```
##    90 Percent confidence interval - lower         0.155
##    90 Percent confidence interval - upper         0.199
##    P-value RMSEA <= 0.05                           0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                            0.126
##
## Parameter Estimates:
##
##    Standard errors                           Standard
##    Information                               Expected
##    Information saturated (h1) model          Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    Aesthetic =~
##      AEST1            1.000                                0.909    0.813
##      AEST2            0.545    0.220    2.477    0.013     0.495    0.494
##      AEST5            0.590    0.278    2.122    0.034     0.537    0.415
##    Challenge =~
##      CHAL1            1.000                                1.083    0.753
##      CHAL2            0.880    0.283    3.112    0.002     0.954    0.536
##      CHAL3            0.738    0.153    4.829    0.000     0.799    0.811
##      CHAL4            1.050    0.210    4.992    0.000     1.138    0.838
##      CHAL5            0.952    0.197    4.829    0.000     1.032    0.811
##    Goals =~
##      GOAL1            1.000                                1.061    0.529
##      GOAL2            0.625    0.291    2.149    0.032     0.663    0.463
##      GOAL3            0.950    0.339    2.799    0.005     1.008    0.709
##      GOAL4            1.435    0.488    2.942    0.003     1.522    0.818
##      GOAL5            0.691    0.270    2.564    0.010     0.733    0.603
##    Narrative =~
##      NARR1            1.000                                0.989    0.764
##      NARR2            0.657    0.178    3.699    0.000     0.650    0.661
##      NARR3            1.177    0.277    4.247    0.000     1.164    0.767
##      NARR4            0.846    0.234    3.610    0.000     0.837    0.645
##      NARR5            0.615    0.212    2.902    0.004     0.609    0.521
##    Social =~
##      SOCI1            1.000                                1.000    0.768
##      SOCI2            1.170    0.249    4.700    0.000     1.170    0.745
##      SOCI3            1.238    0.228    5.435    0.000     1.238    0.840
##      SOCI4            1.644    0.268    6.126    0.000     1.645    0.943
##      SOCI5            1.028    0.287    3.586    0.000     1.028    0.587
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    Aesthetic ~~
##      Challenge        0.215    0.212    1.015    0.310     0.219    0.219
##      Goals            0.033    0.212    0.154    0.878     0.034    0.034
##      Narrative        0.549    0.232    2.362    0.018     0.610    0.610
##      Social           0.575    0.228    2.524    0.012     0.633    0.633
##    Challenge ~~
##      Goals            0.514    0.293    1.752    0.080     0.447    0.447
##      Narrative        0.261    0.220    1.189    0.234     0.244    0.244
##      Social           0.136    0.202    0.676    0.499     0.126    0.126
##    Goals ~~
##      Narrative        0.344    0.248    1.391    0.164     0.328    0.328
##      Social          -0.179    0.214   -0.838    0.402    -0.169   -0.169
##    Narrative ~~
##      Social           0.314    0.205    1.533    0.125     0.317    0.317
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##     .AEST1            0.423    0.257    1.646    0.100     0.423    0.338
```

```
##    .AEST2             0.761   0.198   3.843   0.000   0.761   0.756
##    .AEST5             1.385   0.347   3.991   0.000   1.385   0.828
##    .CHAL1             0.897   0.253   3.544   0.000   0.897   0.433
##    .CHAL2             2.254   0.559   4.031   0.000   2.254   0.713
##    .CHAL3             0.333   0.104   3.207   0.001   0.333   0.343
##    .CHAL4             0.548   0.185   2.964   0.003   0.548   0.297
##    .CHAL5             0.556   0.173   3.208   0.001   0.556   0.343
##    .GOAL1             2.902   0.747   3.883   0.000   2.902   0.721
##    .GOAL2             1.613   0.404   3.992   0.000   1.613   0.786
##    .GOAL3             1.005   0.309   3.256   0.001   1.005   0.497
##    .GOAL4             1.149   0.490   2.343   0.019   1.149   0.332
##    .GOAL5             0.940   0.254   3.704   0.000   0.940   0.636
##    .NARR1             0.696   0.227   3.067   0.002   0.696   0.416
##    .NARR2             0.543   0.151   3.600   0.000   0.543   0.563
##    .NARR3             0.949   0.311   3.048   0.002   0.949   0.412
##    .NARR4             0.981   0.269   3.653   0.000   0.981   0.583
##    .NARR5             0.997   0.253   3.939   0.000   0.997   0.729
##    .SOCI1             0.694   0.184   3.765   0.000   0.694   0.410
##    .SOCI2             1.102   0.287   3.836   0.000   1.102   0.446
##    .SOCI3             0.640   0.189   3.391   0.001   0.640   0.295
##    .SOCI4             0.339   0.196   1.733   0.083   0.339   0.111
##    .SOCI5             2.006   0.492   4.078   0.000   2.006   0.655
##     Aesthetic         0.826   0.364   2.268   0.023   1.000   1.000
##     Challenge         1.174   0.461   2.543   0.011   1.000   1.000
##     Goals             1.125   0.724   1.555   0.120   1.000   1.000
##     Narrative         0.979   0.392   2.497   0.013   1.000   1.000
##     Social            1.000   0.374   2.674   0.008   1.000   1.000
```

Adjustment : Remove Aesthetic

```
## lavaan 0.6-9 ended normally after 46 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        46
##
##    Number of observations                            36
##
## Model Test User Model:
##
##    Test statistic                               301.453
##    Degrees of freedom                               164
##    P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##    Test statistic                               598.837
##    Degrees of freedom                               190
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.664
##    Tucker-Lewis Index (TLI)                       0.610
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -1124.625
##    Loglikelihood unrestricted model (H1)       -973.898
##
##    Akaike (AIC)                                2341.250
##    Bayesian (BIC)                              2414.092
##    Sample-size adjusted Bayesian (BIC)         2270.388
##
## Root Mean Square Error of Approximation:
```

```
## 
##   RMSEA                                              0.153
##   90 Percent confidence interval - lower             0.125
##   90 Percent confidence interval - upper             0.179
##   P-value RMSEA <= 0.05                              0.000
## 
## Standardized Root Mean Square Residual:
## 
##   SRMR                                               0.127
## 
## Parameter Estimates:
## 
##   Standard errors                             Standard
##   Information                                 Expected
##   Information saturated (h1) model          Structured
## 
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Challenge =~
##     CHAL1             1.000                                1.079    0.750
##     CHAL2             0.887    0.285    3.117    0.002      0.957    0.538
##     CHAL3             0.738    0.154    4.788    0.000      0.796    0.808
##     CHAL4             1.055    0.212    4.969    0.000      1.139    0.839
##     CHAL5             0.961    0.199    4.828    0.000      1.037    0.815
##   Goals =~
##     GOAL1             1.000                                1.069    0.533
##     GOAL2             0.636    0.290    2.197    0.028      0.680    0.475
##     GOAL3             0.931    0.333    2.797    0.005      0.995    0.700
##     GOAL4             1.409    0.477    2.955    0.003      1.507    0.809
##     GOAL5             0.697    0.268    2.599    0.009      0.745    0.613
##   Narrative =~
##     NARR1             1.000                                0.907    0.701
##     NARR2             0.636    0.203    3.132    0.002      0.577    0.587
##     NARR3             1.399    0.339    4.126    0.000      1.269    0.836
##     NARR4             0.984    0.272    3.616    0.000      0.893    0.688
##     NARR5             0.666    0.240    2.778    0.005      0.604    0.517
##   Social =~
##     SOCI1             1.000                                0.982    0.754
##     SOCI2             1.187    0.256    4.630    0.000      1.166    0.741
##     SOCI3             1.240    0.236    5.249    0.000      1.218    0.826
##     SOCI4             1.709    0.282    6.053    0.000      1.678    0.962
##     SOCI5             1.033    0.293    3.523    0.000      1.015    0.580
## 
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Challenge ~~
##     Goals             0.515    0.294    1.752    0.080      0.446    0.446
##     Narrative         0.207    0.198    1.042    0.298      0.211    0.211
##     Social            0.129    0.196    0.658    0.510      0.122    0.122
##   Goals ~~
##     Narrative         0.340    0.235    1.450    0.147      0.351    0.351
##     Social           -0.178    0.211   -0.847    0.397     -0.170   -0.170
##   Narrative ~~
##     Social            0.307    0.188    1.628    0.104      0.344    0.344
## 
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .CHAL1            0.907    0.255    3.557    0.000      0.907    0.438
##    .CHAL2            2.248    0.558    4.029    0.000      2.248    0.710
##    .CHAL3            0.337    0.105    3.227    0.001      0.337    0.347
##    .CHAL4            0.545    0.185    2.955    0.003      0.545    0.296
##    .CHAL5            0.545    0.172    3.175    0.001      0.545    0.336
##    .GOAL1            2.884    0.745    3.872    0.000      2.884    0.716
##    .GOAL2            1.590    0.400    3.972    0.000      1.590    0.774
##    .GOAL3            1.030    0.312    3.306    0.001      1.030    0.510
```

```
##    .GOAL4              1.195   0.490   2.438   0.015   1.195   0.345
##    .GOAL5              0.924   0.252   3.672   0.000   0.924   0.625
##    .NARR1              0.853   0.248   3.438   0.001   0.853   0.509
##    .NARR2              0.632   0.166   3.816   0.000   0.632   0.655
##    .NARR3              0.695   0.295   2.354   0.019   0.695   0.302
##    .NARR4              0.885   0.253   3.494   0.000   0.885   0.526
##    .NARR5              1.002   0.254   3.950   0.000   1.002   0.733
##    .SOCI1              0.730   0.189   3.856   0.000   0.730   0.431
##    .SOCI2              1.113   0.286   3.891   0.000   1.113   0.450
##    .SOCI3              0.690   0.195   3.535   0.000   0.690   0.318
##    .SOCI4              0.227   0.192   1.180   0.238   0.227   0.074
##    .SOCI5              2.035   0.495   4.112   0.000   2.035   0.664
##    Challenge           1.164   0.460   2.529   0.011   1.000   1.000
##    Goals               1.143   0.729   1.567   0.117   1.000   1.000
##    Narrative           0.823   0.370   2.225   0.026   1.000   1.000
##    Social              0.964   0.369   2.614   0.009   1.000   1.000
```

Adjusted on All Traits   Adjustment : Remove AEST4, CHAL2, GOAL2, NARR5, SOCI5

```
## lavaan 0.6-9 ended normally after 50 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        50
##
##    Number of observations                            36
##
## Model Test User Model:
##
##    Test statistic                               288.780
##    Degrees of freedom                               160
##    P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##    Test statistic                               577.208
##    Degrees of freedom                               190
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.667
##    Tucker-Lewis Index (TLI)                       0.605
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -1085.252
##    Loglikelihood unrestricted model (H1)       -940.862
##
##    Akaike (AIC)                                2270.503
##    Bayesian (BIC)                              2349.679
##    Sample-size adjusted Bayesian (BIC)         2193.480
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                          0.150
##    90 Percent confidence interval - lower         0.122
##    90 Percent confidence interval - upper         0.177
##    P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                           0.119
##
```

```
## Parameter Estimates:
##
##   Standard errors                              Standard
##   Information                                  Expected
##   Information saturated (h1) model            Structured
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##   Aesthetic =~
##     AEST1            1.000                                0.937    0.838
##     AEST2            0.530    0.203    2.614    0.009     0.496    0.495
##     AEST3            0.352    0.211    1.666    0.096     0.330    0.310
##     AEST5            0.522    0.258    2.022    0.043     0.489    0.378
##   Challenge =~
##     CHAL1            1.000                                1.089    0.757
##     CHAL3            0.732    0.152    4.819    0.000     0.797    0.809
##     CHAL4            1.053    0.210    5.023    0.000     1.146    0.845
##     CHAL5            0.936    0.196    4.772    0.000     1.020    0.801
##   Goals =~
##     GOAL1            1.000                                0.910    0.454
##     GOAL3            1.114    0.450    2.474    0.013     1.014    0.713
##     GOAL4            1.793    0.701    2.557    0.011     1.632    0.877
##     GOAL5            0.784    0.345    2.274    0.023     0.714    0.587
##   Narrative =~
##     NARR1            1.000                                1.111    0.859
##     NARR2            0.561    0.150    3.744    0.000     0.624    0.635
##     NARR3            0.990    0.231    4.294    0.000     1.101    0.725
##     NARR4            0.659    0.200    3.296    0.001     0.733    0.565
##   Social =~
##     SOCI1            1.000                                0.996    0.765
##     SOCI2            1.189    0.252    4.720    0.000     1.185    0.754
##     SOCI3            1.255    0.231    5.428    0.000     1.250    0.848
##     SOCI4            1.636    0.275    5.953    0.000     1.630    0.934
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##   Aesthetic ~~
##     Challenge        0.283    0.219    1.292    0.196     0.277    0.277
##     Goals            0.007    0.180    0.040    0.968     0.008    0.008
##     Narrative        0.629    0.252    2.493    0.013     0.604    0.604
##     Social           0.585    0.230    2.551    0.011     0.627    0.627
##   Challenge ~~
##     Goals            0.448    0.269    1.667    0.096     0.452    0.452
##     Narrative        0.332    0.248    1.339    0.181     0.274    0.274
##     Social           0.139    0.203    0.681    0.496     0.128    0.128
##   Goals ~~
##     Narrative        0.319    0.239    1.333    0.183     0.315    0.315
##     Social          -0.132    0.180   -0.730    0.465    -0.145   -0.145
##   Narrative ~~
##     Social           0.250    0.218    1.145    0.252     0.226    0.226
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    .AEST1           0.371    0.234    1.588    0.112     0.371    0.297
##    .AEST2           0.760    0.195    3.905    0.000     0.760    0.755
##    .AEST3           1.023    0.247    4.136    0.000     1.023    0.904
##    .AEST5           1.434    0.352    4.074    0.000     1.434    0.857
##    .CHAL1           0.885    0.254    3.491    0.000     0.885    0.427
##    .CHAL3           0.336    0.106    3.166    0.002     0.336    0.346
##    .CHAL4           0.528    0.187    2.826    0.005     0.528    0.286
##    .CHAL5           0.580    0.180    3.225    0.001     0.580    0.358
##    .GOAL1           3.199    0.793    4.032    0.000     3.199    0.794
##    .GOAL3           0.993    0.307    3.232    0.001     0.993    0.491
##    .GOAL4           0.802    0.516    1.553    0.120     0.802    0.231
##    .GOAL5           0.969    0.256    3.789    0.000     0.969    0.655
```

```
##    .NARR1                     0.440    0.218    2.019    0.044    0.440    0.263
##    .NARR2                     0.576    0.156    3.696    0.000    0.576    0.597
##    .NARR3                     1.093    0.331    3.300    0.001    1.093    0.474
##    .NARR4                     1.145    0.296    3.872    0.000    1.145    0.681
##    .SOCI1                     0.702    0.188    3.723    0.000    0.702    0.414
##    .SOCI2                     1.068    0.284    3.764    0.000    1.068    0.432
##    .SOCI3                     0.610    0.189    3.220    0.001    0.610    0.281
##    .SOCI4                     0.387    0.215    1.805    0.071    0.387    0.127
##     Aesthetic                 0.878    0.355    2.474    0.013    1.000    1.000
##     Challenge                 1.186    0.464    2.554    0.011    1.000    1.000
##     Goals                     0.828    0.627    1.321    0.187    1.000    1.000
##     Narrative                 1.235    0.427    2.895    0.004    1.000    1.000
##     Social                    0.993    0.375    2.650    0.008    1.000    1.000
```

Adjustment : Remove Aesthetic, CHAL2, GOAL2, NARR5, SOCI5

```
## lavaan 0.6-9 ended normally after 44 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        38
##
##    Number of observations                            36
##
## Model Test User Model:
##
##    Test statistic                               140.828
##    Degrees of freedom                                98
##    P-value (Chi-square)                           0.003
##
## Model Test Baseline Model:
##
##    Test statistic                               398.473
##    Degrees of freedom                               120
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.846
##    Tucker-Lewis Index (TLI)                       0.812
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)               -880.708
##    Loglikelihood unrestricted model (H1)       -810.294
##
##    Akaike (AIC)                                1837.416
##    Bayesian (BIC)                              1897.590
##    Sample-size adjusted Bayesian (BIC)         1778.878
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                          0.110
##    90 Percent confidence interval - lower         0.066
##    90 Percent confidence interval - upper         0.149
##    P-value RMSEA <= 0.05                          0.019
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                           0.111
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Expected
```

```
##    Information saturated (h1) model         Structured
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Challenge =~
##     CHAL1            1.000                               1.077    0.748
##     CHAL3            0.737    0.156    4.733    0.000    0.794    0.805
##     CHAL4            1.068    0.215    4.962    0.000    1.150    0.847
##     CHAL5            0.957    0.201    4.762    0.000    1.031    0.810
##   Goals =~
##     GOAL1            1.000                               0.928    0.462
##     GOAL3            1.085    0.434    2.498    0.012    1.006    0.708
##     GOAL4            1.731    0.665    2.601    0.009    1.606    0.863
##     GOAL5            0.797    0.341    2.338    0.019    0.740    0.608
##   Narrative =~
##     NARR1            1.000                               0.917    0.709
##     NARR2            0.545    0.197    2.771    0.006    0.500    0.509
##     NARR3            1.446    0.350    4.138    0.000    1.326    0.874
##     NARR4            0.956    0.264    3.624    0.000    0.877    0.676
##   Social =~
##     SOCI1            1.000                               0.982    0.754
##     SOCI2            1.197    0.258    4.647    0.000    1.175    0.748
##     SOCI3            1.249    0.238    5.253    0.000    1.226    0.831
##     SOCI4            1.698    0.287    5.911    0.000    1.667    0.955
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Challenge ~~
##     Goals            0.453    0.270    1.677    0.094    0.454    0.454
##     Narrative        0.199    0.199    0.999    0.318    0.201    0.201
##     Social           0.134    0.197    0.679    0.497    0.126    0.126
##   Goals ~~
##     Narrative        0.298    0.212    1.406    0.160    0.350    0.350
##     Social          -0.131    0.181   -0.726    0.468   -0.144   -0.144
##   Narrative ~~
##     Social           0.289    0.188    1.536    0.125    0.321    0.321
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .CHAL1           0.911    0.258    3.529    0.000    0.911    0.440
##    .CHAL3           0.342    0.107    3.193    0.001    0.342    0.352
##    .CHAL4           0.520    0.186    2.794    0.005    0.520    0.282
##    .CHAL5           0.556    0.176    3.154    0.002    0.556    0.344
##    .GOAL1           3.166    0.789    4.013    0.000    3.166    0.786
##    .GOAL3           1.008    0.308    3.274    0.001    1.008    0.499
##    .GOAL4           0.887    0.503    1.763    0.078    0.887    0.256
##    .GOAL5           0.931    0.250    3.719    0.000    0.931    0.630
##    .NARR1           0.834    0.249    3.357    0.001    0.834    0.498
##    .NARR2           0.715    0.180    3.968    0.000    0.715    0.741
##    .NARR3           0.546    0.317    1.724    0.085    0.546    0.237
##    .NARR4           0.913    0.259    3.524    0.000    0.913    0.543
##    .SOCI1           0.731    0.192    3.800    0.000    0.731    0.431
##    .SOCI2           1.090    0.285    3.820    0.000    1.090    0.441
##    .SOCI3           0.671    0.198    3.386    0.001    0.671    0.309
##    .SOCI4           0.265    0.215    1.235    0.217    0.265    0.087
##     Challenge       1.160    0.461    2.515    0.012    1.000    1.000
##     Goals           0.861    0.640    1.345    0.179    1.000    1.000
##     Narrative       0.841    0.375    2.245    0.025    1.000    1.000
##     Social          0.964    0.370    2.602    0.009    1.000    1.000
```

SEM for Flow using Lavaan

Flow Model for All Scenario

```
## Warning in lav_object_post_check(object): lavaan WARNING: covariance matrix of latent variables
##              is not positive definite;
##              use lavInspect(fit, "cov.lv") to investigate.
```

```
## lavaan 0.6-9 ended normally after 81 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                       108
##
##   Number of observations                           108
##
## Model Test User Model:
##
##   Test statistic                               938.797
##   Degrees of freedom                               558
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                              3601.064
##   Degrees of freedom                               630
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.872
##   Tucker-Lewis Index (TLI)                       0.855
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -5627.204
##   Loglikelihood unrestricted model (H1)      -5157.806
##
##   Akaike (AIC)                               11470.409
##   Bayesian (BIC)                             11760.079
##   Sample-size adjusted Bayesian (BIC)        11418.831
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.079
##   90 Percent confidence interval - lower         0.071
##   90 Percent confidence interval - upper         0.088
##   P-value RMSEA <= 0.05                          0.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.072
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Expected
##   Information saturated (h1) model           Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Chal.Skill.Balance =~
##     CSB1              1.000                                1.004    0.583
##     CSB2              1.064    0.166    6.410    0.000     1.068    0.835
##     CSB3              1.016    0.161    6.300    0.000     1.019    0.810
```

```
##    CSB4              1.237    0.184    6.717    0.000    1.241    0.925
##  Action.Awareness =~
##    AA1               1.000                               1.203    0.783
##    AA2               0.971    0.112    8.678    0.000    1.169    0.794
##    AA3               0.850    0.097    8.717    0.000    1.022    0.797
##    AA4               0.947    0.110    8.645    0.000    1.140    0.791
##  Clear.Goals =~
##    CG1               1.000                               1.566    0.830
##    CG2               0.959    0.077   12.371    0.000    1.501    0.914
##    CG3               0.689    0.109    6.350    0.000    1.079    0.570
##    CG4               1.008    0.096   10.530    0.000    1.578    0.829
##  Unambiguous.Fdbck =~
##    UF1               1.000                               1.257    0.675
##    UF2               0.753    0.109    6.896    0.000    0.946    0.668
##    UF3               0.915    0.115    7.976    0.000    1.150    0.786
##    UF4               0.808    0.127    6.341    0.000    1.015    0.610
##  Concentration =~
##    CNT1              1.000                               0.688    0.640
##    CNT2              1.200    0.180    6.653    0.000    0.826    0.752
##    CNT3              1.412    0.195    7.246    0.000    0.972    0.842
##    CNT4              1.619    0.212    7.640    0.000    1.114    0.926
##  Sense.of.Control =~
##    SOC1              1.000                               0.909    0.704
##    SOC2              1.082    0.140    7.750    0.000    0.984    0.801
##    SOC3              1.314    0.172    7.620    0.000    1.195    0.787
##    SOC4              1.311    0.154    8.518    0.000    1.192    0.898
##  Loss.Self.Cnscsnss =~
##    LSC1              1.000                               1.377    0.741
##    LSC2              1.063    0.103   10.308    0.000    1.464    0.951
##    LSC3              0.817    0.101    8.102    0.000    1.125    0.761
##    LSC4              1.143    0.114   10.059    0.000    1.574    0.925
##  Time.Trnsfrmtn =~
##    TT1               1.000                               1.977    0.976
##    TT2               0.937    0.044   21.236    0.000    1.852    0.926
##    TT3               0.735    0.080    9.204    0.000    1.454    0.678
##    TT4               0.922    0.040   23.235    0.000    1.823    0.943
##  Autotelic.Exprnc =~
##    AE1               1.000                               0.663    0.802
##    AE2               0.880    0.140    6.264    0.000    0.583    0.592
##    AE3               1.253    0.127    9.840    0.000    0.831    0.916
##    AE4               1.303    0.165    7.908    0.000    0.865    0.720
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##  Chal.Skill.Balance ~~
##    Action.Awarnss    0.750    0.189    3.964    0.000    0.621    0.621
##    Clear.Goals       0.601    0.198    3.045    0.002    0.383    0.383
##    Unambigs.Fdbck    0.617    0.185    3.340    0.001    0.489    0.489
##    Concentration     0.328    0.099    3.310    0.001    0.475    0.475
##    Sense.of.Cntrl    0.456    0.131    3.471    0.001    0.500    0.500
##    Lss.Slf.Cnscsn    0.510    0.172    2.957    0.003    0.369    0.369
##    Time.Trnsfrmtn    0.100    0.203    0.491    0.623    0.050    0.050
##    Autotlc.Exprnc    0.184    0.079    2.350    0.019    0.277    0.277
##  Action.Awareness ~~
##    Clear.Goals       1.213    0.261    4.649    0.000    0.644    0.644
##    Unambigs.Fdbck    1.231    0.255    4.832    0.000    0.814    0.814
##    Concentration     0.482    0.121    3.988    0.000    0.582    0.582
##    Sense.of.Cntrl    0.741    0.166    4.473    0.000    0.677    0.677
##    Lss.Slf.Cnscsn    0.811    0.213    3.806    0.000    0.489    0.489
##    Time.Trnsfrmtn   -0.219    0.250   -0.876    0.381   -0.092   -0.092
##    Autotlc.Exprnc    0.215    0.092    2.331    0.020    0.269    0.269
##  Clear.Goals ~~
##    Unambigs.Fdbck    2.041    0.370    5.522    0.000    1.037    1.037
##    Concentration     0.543    0.144    3.761    0.000    0.504    0.504
##    Sense.of.Cntrl    0.889    0.202    4.405    0.000    0.624    0.624
```

```
##    Lss.Slf.Cnscsn          0.495    0.235    2.110    0.035    0.229    0.229
##    Time.Trnsfrmtn         -0.224    0.318   -0.704    0.481   -0.072   -0.072
##    Autotlc.Exprnc          0.436    0.126    3.474    0.001    0.420    0.420
## Unambiguous.Fdbck ~~
##    Concentration           0.496    0.131    3.776    0.000    0.573    0.573
##    Sense.of.Cntrl          0.814    0.187    4.361    0.000    0.712    0.712
##    Lss.Slf.Cnscsn          0.798    0.230    3.473    0.001    0.461    0.461
##    Time.Trnsfrmtn         -0.127    0.273   -0.467    0.641   -0.051   -0.051
##    Autotlc.Exprnc          0.343    0.108    3.160    0.002    0.411    0.411
## Concentration ~~
##    Sense.of.Cntrl          0.355    0.093    3.839    0.000    0.568    0.568
##    Lss.Slf.Cnscsn          0.461    0.127    3.626    0.000    0.486    0.486
##    Time.Trnsfrmtn          0.050    0.139    0.358    0.721    0.037    0.037
##    Autotlc.Exprnc          0.107    0.052    2.065    0.039    0.235    0.235
## Sense.of.Control ~~
##    Lss.Slf.Cnscsn          0.464    0.151    3.072    0.002    0.370    0.370
##    Time.Trnsfrmtn         -0.126    0.186   -0.674    0.500   -0.070   -0.070
##    Autotlc.Exprnc          0.203    0.072    2.811    0.005    0.336    0.336
## Loss.Self.Cnscsnss ~~
##    Time.Trnsfrmtn          0.333    0.276    1.205    0.228    0.122    0.122
##    Autotlc.Exprnc          0.054    0.096    0.568    0.570    0.060    0.060
## Time.Trnsfrmtn ~~
##    Autotlc.Exprnc          0.196    0.137    1.428    0.153    0.150    0.150
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .CSB1             1.955    0.279    7.005    0.000    1.955    0.660
##    .CSB2             0.497    0.088    5.624    0.000    0.497    0.303
##    .CSB3             0.544    0.091    5.955    0.000    0.544    0.344
##    .CSB4             0.259    0.079    3.258    0.001    0.259    0.144
##    .AA1              0.913    0.152    6.010    0.000    0.913    0.387
##    .AA2              0.802    0.136    5.908    0.000    0.802    0.370
##    .AA3              0.600    0.102    5.877    0.000    0.600    0.365
##    .AA4              0.776    0.131    5.933    0.000    0.776    0.374
##    .CG1              1.108    0.173    6.417    0.000    1.108    0.311
##    .CG2              0.445    0.088    5.034    0.000    0.445    0.165
##    .CG3              2.415    0.338    7.153    0.000    2.415    0.675
##    .CG4              1.138    0.177    6.427    0.000    1.138    0.314
##    .UF1              1.887    0.255    7.405    0.000    1.887    0.544
##    .UF2              1.109    0.150    7.414    0.000    1.109    0.553
##    .UF3              0.818    0.117    7.011    0.000    0.818    0.382
##    .UF4              1.738    0.233    7.461    0.000    1.738    0.628
##    .CNT1             0.681    0.099    6.879    0.000    0.681    0.590
##    .CNT2             0.524    0.081    6.433    0.000    0.524    0.435
##    .CNT3             0.387    0.071    5.476    0.000    0.387    0.291
##    .CNT4             0.205    0.064    3.194    0.001    0.205    0.142
##    .SOC1             0.841    0.128    6.583    0.000    0.841    0.504
##    .SOC2             0.541    0.092    5.911    0.000    0.541    0.359
##    .SOC3             0.880    0.145    6.054    0.000    0.880    0.381
##    .SOC4             0.341    0.084    4.071    0.000    0.341    0.194
##    .LSC1             1.559    0.228    6.853    0.000    1.559    0.451
##    .LSC2             0.225    0.071    3.146    0.002    0.225    0.095
##    .LSC3             0.920    0.136    6.785    0.000    0.920    0.421
##    .LSC4             0.420    0.095    4.417    0.000    0.420    0.145
##    .TT1              0.199    0.071    2.810    0.005    0.199    0.048
##    .TT2              0.567    0.097    5.823    0.000    0.567    0.142
##    .TT3              2.484    0.347    7.164    0.000    2.484    0.540
##    .TT4              0.414    0.080    5.184    0.000    0.414    0.111
##    .AE1              0.244    0.045    5.472    0.000    0.244    0.357
##    .AE2              0.631    0.092    6.873    0.000    0.631    0.650
##    .AE3              0.133    0.048    2.799    0.005    0.133    0.162
##    .AE4              0.694    0.110    6.333    0.000    0.694    0.481
##     Chal.Skll.Blnc   1.007    0.314    3.204    0.001    1.000    1.000
##     Action.Awarnss   1.447    0.309    4.686    0.000    1.000    1.000
##     Clear.Goals      2.452    0.468    5.239    0.000    1.000    1.000
```

```
##      Unambigs.Fdbck    1.580    0.395    4.005    0.000    1.000    1.000
##      Concentration     0.473    0.132    3.599    0.000    1.000    1.000
##      Sense.of.Cntrl    0.826    0.204    4.051    0.000    1.000    1.000
##      Lss.Slf.Cnscsn    1.896    0.428    4.434    0.000    1.000    1.000
##      Time.Trnsfrmtn    3.907    0.562    6.954    0.000    1.000    1.000
##      Autotlc.Exprnc    0.440    0.092    4.787    0.000    1.000    1.000
```

SEM for Engagement using Lavaan

Default Engagement Models

All Scenario

```
## lavaan 0.6-9 ended normally after 36 iterations
##
##      Estimator                                         ML
##      Optimization method                           NLMINB
##      Number of model parameters                        12
##
##      Number of observations                           108
##
## Model Test User Model:
##
##      Test statistic                                26.136
##      Degrees of freedom                                 9
##      P-value (Chi-square)                           0.002
##
## Model Test Baseline Model:
##
##      Test statistic                               130.612
##      Degrees of freedom                                15
##      P-value                                        0.000
##
## User Model versus Baseline Model:
##
##      Comparative Fit Index (CFI)                    0.852
##      Tucker-Lewis Index (TLI)                       0.753
##
## Loglikelihood and Information Criteria:
##
##      Loglikelihood user model (H0)               -983.245
##      Loglikelihood unrestricted model (H1)       -970.177
##
##      Akaike (AIC)                                1990.490
##      Bayesian (BIC)                              2022.675
##      Sample-size adjusted Bayesian (BIC)         1984.759
##
## Root Mean Square Error of Approximation:
##
##      RMSEA                                          0.133
##      90 Percent confidence interval - lower         0.075
##      90 Percent confidence interval - upper         0.194
##      P-value RMSEA <= 0.05                          0.013
##
## Standardized Root Mean Square Residual:
##
##      SRMR                                           0.075
##
## Parameter Estimates:
##
##      Standard errors                             Standard
##      Information                                 Expected
##      Information saturated (h1) model          Structured
##
```

```
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Engagement =~
##     ENG1             1.000                                0.473    0.652
##     ENG2             1.487    0.280    5.304    0.000      0.704    0.747
##     ENG3             1.591    0.325    4.893    0.000      0.753    0.622
##     ENG4             1.225    0.328    3.736    0.000      0.579    0.442
##     ENG5             1.264    0.379    3.331    0.001      0.598    0.387
##     ENG6             1.479    0.431    3.432    0.001      0.700    0.401
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .ENG1            0.303    0.054    5.567    0.000      0.303    0.575
##    .ENG2            0.393    0.090    4.353    0.000      0.393    0.442
##    .ENG3            0.899    0.154    5.842    0.000      0.899    0.613
##    .ENG4            1.385    0.204    6.788    0.000      1.385    0.805
##    .ENG5            2.024    0.292    6.942    0.000      2.024    0.850
##    .ENG6            2.561    0.371    6.908    0.000      2.561    0.839
##     Engagement      0.224    0.069    3.262    0.001      1.000    1.000
```

Aesthetic Scenario

```
## lavaan 0.6-9 ended normally after 34 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                        12
##
##   Number of observations                            36
##
## Model Test User Model:
##
##   Test statistic                                17.909
##   Degrees of freedom                                 9
##   P-value (Chi-square)                           0.036
##
## Model Test Baseline Model:
##
##   Test statistic                                61.311
##   Degrees of freedom                                15
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.808
##   Tucker-Lewis Index (TLI)                       0.679
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)               -330.544
##   Loglikelihood unrestricted model (H1)       -321.589
##
##   Akaike (AIC)                                 685.088
##   Bayesian (BIC)                               704.090
##   Sample-size adjusted Bayesian (BIC)          666.602
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.166
##   90 Percent confidence interval - lower         0.041
##   90 Percent confidence interval - upper         0.278
##   P-value RMSEA <= 0.05                          0.058
##
## Standardized Root Mean Square Residual:
##
```

```
##    SRMR                                            0.125
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Expected
##    Information saturated (h1) model          Structured
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    Engagement =~
##      ENG1            1.000                                0.494    0.676
##      ENG2            2.328    0.627    3.712    0.000    1.150    0.997
##      ENG3            1.435    0.420    3.417    0.001    0.709    0.590
##      ENG4            0.555    0.450    1.233    0.217    0.274    0.207
##      ENG5            0.993    0.623    1.594    0.111    0.490    0.268
##      ENG6            0.704    0.495    1.423    0.155    0.348    0.239
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##     .ENG1           0.290    0.084    3.458    0.001    0.290    0.543
##     .ENG2           0.008    0.263    0.032    0.975    0.008    0.006
##     .ENG3           0.942    0.244    3.867    0.000    0.942    0.652
##     .ENG4           1.675    0.395    4.239    0.000    1.675    0.957
##     .ENG5           3.101    0.733    4.232    0.000    3.101    0.928
##     .ENG6           1.996    0.471    4.236    0.000    1.996    0.943
##      Engagement     0.244    0.116    2.098    0.036    1.000    1.000
```

Narrative Scenario

```
## lavaan 0.6-9 ended normally after 28 iterations
##
##    Estimator                                         ML
##    Optimization method                          NLMINB
##    Number of model parameters                       12
##
##    Number of observations                           36
##
## Model Test User Model:
##
##    Test statistic                               21.929
##    Degrees of freedom                                9
##    P-value (Chi-square)                          0.009
##
## Model Test Baseline Model:
##
##    Test statistic                               80.548
##    Degrees of freedom                               15
##    P-value                                       0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                   0.803
##    Tucker-Lewis Index (TLI)                      0.671
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -285.642
##    Loglikelihood unrestricted model (H1)      -274.677
##
##    Akaike (AIC)                                595.284
##    Bayesian (BIC)                              614.286
##    Sample-size adjusted Bayesian (BIC)         576.799
##
## Root Mean Square Error of Approximation:
```

```
##
##   RMSEA                                           0.200
##     90 Percent confidence interval - lower        0.094
##     90 Percent confidence interval - upper        0.308
##   P-value RMSEA <= 0.05                           0.017
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                            0.113
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Expected
##   Information saturated (h1) model          Structured
##
## Latent Variables:
##                  Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Engagement =~
##     ENG1            1.000                                0.412    0.692
##     ENG2            0.982    0.420    2.340    0.019     0.404    0.437
##     ENG3            2.249    0.579    3.882    0.000     0.926    0.780
##     ENG4            2.188    0.574    3.814    0.000     0.901    0.759
##     ENG5            1.984    0.580    3.422    0.001     0.817    0.662
##     ENG6            1.354    0.600    2.258    0.024     0.557    0.421
##
## Variances:
##                  Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .ENG1           0.185    0.054    3.447    0.001     0.185    0.521
##    .ENG2           0.691    0.171    4.043    0.000     0.691    0.809
##    .ENG3           0.553    0.192    2.885    0.004     0.553    0.392
##    .ENG4           0.598    0.196    3.052    0.002     0.598    0.424
##    .ENG5           0.854    0.239    3.569    0.000     0.854    0.561
##    .ENG6           1.440    0.355    4.060    0.000     1.440    0.823
##     Engagement     0.169    0.078    2.179    0.029     1.000    1.000
```

Goals Scenario

```
## lavaan 0.6-9 ended normally after 28 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                        12
##
##   Number of observations                            36
##
## Model Test User Model:
##
##   Test statistic                                19.166
##   Degrees of freedom                                 9
##   P-value (Chi-square)                           0.024
##
## Model Test Baseline Model:
##
##   Test statistic                                61.497
##   Degrees of freedom                                15
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.781
##   Tucker-Lewis Index (TLI)                       0.636
##
## Loglikelihood and Information Criteria:
##
```

```
##    Loglikelihood user model (H0)                    -315.606
##    Loglikelihood unrestricted model (H1)            -306.023
##
##    Akaike (AIC)                                      655.212
##    Bayesian (BIC)                                    674.214
##    Sample-size adjusted Bayesian (BIC)               636.726
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                               0.177
##    90 Percent confidence interval - lower              0.062
##    90 Percent confidence interval - upper              0.288
##    P-value RMSEA <= 0.05                               0.040
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                                0.134
##
## Parameter Estimates:
##
##    Standard errors                                 Standard
##    Information                                     Expected
##    Information saturated (h1) model              Structured
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    Engagement =~
##      ENG1            1.000                                0.628    0.771
##      ENG2            1.015    0.255    3.987    0.000     0.637    0.928
##      ENG3            0.798    0.341    2.341    0.019     0.501    0.406
##      ENG4            0.582    0.384    1.515    0.130     0.365    0.265
##      ENG5            0.733    0.382    1.922    0.055     0.461    0.335
##      ENG6            1.056    0.490    2.154    0.031     0.663    0.374
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##      .ENG1           0.269    0.104    2.600    0.009     0.269    0.406
##      .ENG2           0.066    0.085    0.778    0.436     0.066    0.140
##      .ENG3           1.277    0.310    4.122    0.000     1.277    0.836
##      .ENG4           1.762    0.419    4.201    0.000     1.762    0.930
##      .ENG5           1.677    0.402    4.169    0.000     1.677    0.888
##      .ENG6           2.699    0.651    4.145    0.000     2.699    0.860
##       Engagement     0.394    0.165    2.394    0.017     1.000    1.000
```

Adjusted Engagement Models

All Scenario Adjustment : Remove ENG5 and ENG6

```
## lavaan 0.6-9 ended normally after 36 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        12
##
##    Number of observations                           108
##
## Model Test User Model:
##
##    Test statistic                               26.136
##    Degrees of freedom                                9
##    P-value (Chi-square)                          0.002
##
## Model Test Baseline Model:
##
```

```
##    Test statistic                              130.612
##    Degrees of freedom                               15
##    P-value                                       0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                   0.852
##    Tucker-Lewis Index (TLI)                      0.753
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)              -983.245
##    Loglikelihood unrestricted model (H1)      -970.177
##
##    Akaike (AIC)                               1990.490
##    Bayesian (BIC)                             2022.675
##    Sample-size adjusted Bayesian (BIC)        1984.759
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                         0.133
##    90 Percent confidence interval - lower        0.075
##    90 Percent confidence interval - upper        0.194
##    P-value RMSEA <= 0.05                         0.013
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                          0.075
##
## Parameter Estimates:
##
##    Standard errors                            Standard
##    Information                                Expected
##    Information saturated (h1) model         Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    Engagement =~
##      ENG1             1.000                              0.473    0.652
##      ENG2             1.487    0.280    5.304    0.000   0.704    0.747
##      ENG3             1.591    0.325    4.893    0.000   0.753    0.622
##      ENG4             1.225    0.328    3.736    0.000   0.579    0.442
##      ENG5             1.264    0.379    3.331    0.001   0.598    0.387
##      ENG6             1.479    0.431    3.432    0.001   0.700    0.401
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##     .ENG1            0.303    0.054    5.567    0.000    0.303    0.575
##     .ENG2            0.393    0.090    4.353    0.000    0.393    0.442
##     .ENG3            0.899    0.154    5.842    0.000    0.899    0.613
##     .ENG4            1.385    0.204    6.788    0.000    1.385    0.805
##     .ENG5            2.024    0.292    6.942    0.000    2.024    0.850
##     .ENG6            2.561    0.371    6.908    0.000    2.561    0.839
##      Engagement      0.224    0.069    3.262    0.001    1.000    1.000
```

Aesthetic Scenario

```
## lavaan 0.6-9 ended normally after 34 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        12
##
##    Number of observations                            36
##
```

```
## Model Test User Model:
##
##    Test statistic                                17.909
##    Degrees of freedom                                 9
##    P-value (Chi-square)                           0.036
##
## Model Test Baseline Model:
##
##    Test statistic                                61.311
##    Degrees of freedom                                15
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.808
##    Tucker-Lewis Index (TLI)                       0.679
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)               -330.544
##    Loglikelihood unrestricted model (H1)       -321.589
##
##    Akaike (AIC)                                 685.088
##    Bayesian (BIC)                               704.090
##    Sample-size adjusted Bayesian (BIC)          666.602
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                          0.166
##    90 Percent confidence interval - lower         0.041
##    90 Percent confidence interval - upper         0.278
##    P-value RMSEA <= 0.05                           0.058
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                           0.125
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Expected
##    Information saturated (h1) model          Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##    Engagement =~
##      ENG1             1.000                                0.494    0.676
##      ENG2             2.328    0.627    3.712    0.000     1.150    0.997
##      ENG3             1.435    0.420    3.417    0.001     0.709    0.590
##      ENG4             0.555    0.450    1.233    0.217     0.274    0.207
##      ENG5             0.993    0.623    1.594    0.111     0.490    0.268
##      ENG6             0.704    0.495    1.423    0.155     0.348    0.239
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv   Std.all
##     .ENG1             0.290    0.084    3.458    0.001     0.290    0.543
##     .ENG2             0.008    0.263    0.032    0.975     0.008    0.006
##     .ENG3             0.942    0.244    3.867    0.000     0.942    0.652
##     .ENG4             1.675    0.395    4.239    0.000     1.675    0.957
##     .ENG5             3.101    0.733    4.232    0.000     3.101    0.928
##     .ENG6             1.996    0.471    4.236    0.000     1.996    0.943
##      Engagement       0.244    0.116    2.098    0.036     1.000    1.000
```

Narrative Scenario

```
## lavaan 0.6-9 ended normally after 28 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                        12
##
##   Number of observations                            36
##
## Model Test User Model:
##
##   Test statistic                                21.929
##   Degrees of freedom                                 9
##   P-value (Chi-square)                           0.009
##
## Model Test Baseline Model:
##
##   Test statistic                                80.548
##   Degrees of freedom                                15
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.803
##   Tucker-Lewis Index (TLI)                       0.671
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)               -285.642
##   Loglikelihood unrestricted model (H1)       -274.677
##
##   Akaike (AIC)                                 595.284
##   Bayesian (BIC)                               614.286
##   Sample-size adjusted Bayesian (BIC)          576.799
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.200
##   90 Percent confidence interval - lower         0.094
##   90 Percent confidence interval - upper         0.308
##   P-value RMSEA <= 0.05                          0.017
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.113
##
## Parameter Estimates:
##
##   Standard errors                             Standard
##   Information                                 Expected
##   Information saturated (h1) model          Structured
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   Engagement =~
##     ENG1              1.000                                0.412    0.692
##     ENG2              0.982    0.420    2.340    0.019     0.404    0.437
##     ENG3              2.249    0.579    3.882    0.000     0.926    0.780
##     ENG4              2.188    0.574    3.814    0.000     0.901    0.759
##     ENG5              1.984    0.580    3.422    0.001     0.817    0.662
##     ENG6              1.354    0.600    2.258    0.024     0.557    0.421
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .ENG1             0.185    0.054    3.447    0.001     0.185    0.521
##    .ENG2             0.691    0.171    4.043    0.000     0.691    0.809
```

```
##    .ENG3            0.553    0.192    2.885    0.004    0.553    0.392
##    .ENG4            0.598    0.196    3.052    0.002    0.598    0.424
##    .ENG5            0.854    0.239    3.569    0.000    0.854    0.561
##    .ENG6            1.440    0.355    4.060    0.000    1.440    0.823
##     Engagement      0.169    0.078    2.179    0.029    1.000    1.000
```

Goals Scenario

```
## lavaan 0.6-9 ended normally after 28 iterations
##
##    Estimator                                         ML
##    Optimization method                           NLMINB
##    Number of model parameters                        12
##
##    Number of observations                            36
##
## Model Test User Model:
##
##    Test statistic                                19.166
##    Degrees of freedom                                 9
##    P-value (Chi-square)                           0.024
##
## Model Test Baseline Model:
##
##    Test statistic                                61.497
##    Degrees of freedom                                15
##    P-value                                        0.000
##
## User Model versus Baseline Model:
##
##    Comparative Fit Index (CFI)                    0.781
##    Tucker-Lewis Index (TLI)                       0.636
##
## Loglikelihood and Information Criteria:
##
##    Loglikelihood user model (H0)               -315.606
##    Loglikelihood unrestricted model (H1)       -306.023
##
##    Akaike (AIC)                                 655.212
##    Bayesian (BIC)                               674.214
##    Sample-size adjusted Bayesian (BIC)          636.726
##
## Root Mean Square Error of Approximation:
##
##    RMSEA                                          0.177
##    90 Percent confidence interval - lower         0.062
##    90 Percent confidence interval - upper         0.288
##    P-value RMSEA <= 0.05                           0.040
##
## Standardized Root Mean Square Residual:
##
##    SRMR                                           0.134
##
## Parameter Estimates:
##
##    Standard errors                             Standard
##    Information                                 Expected
##    Information saturated (h1) model          Structured
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    Engagement =~
##      ENG1            1.000                               0.628    0.771
##      ENG2            1.015    0.255    3.987    0.000    0.637    0.928
##      ENG3            0.798    0.341    2.341    0.019    0.501    0.406
```

```
##     ENG4           0.582    0.384    1.515   0.130    0.365    0.265
##     ENG5           0.733    0.382    1.922   0.055    0.461    0.335
##     ENG6           1.056    0.490    2.154   0.031    0.663    0.374
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)  Std.lv   Std.all
##    .ENG1           0.269    0.104    2.600   0.009    0.269    0.406
##    .ENG2           0.066    0.085    0.778   0.436    0.066    0.140
##    .ENG3           1.277    0.310    4.122   0.000    1.277    0.836
##    .ENG4           1.762    0.419    4.201   0.000    1.762    0.930
##    .ENG5           1.677    0.402    4.169   0.000    1.677    0.888
##    .ENG6           2.699    0.651    4.145   0.000    2.699    0.860
##     Engagement     0.394    0.165    2.394   0.017    1.000    1.000
```

```
                   Estimate  Std.Err  z-value  P(>|z|)  Std.lv   Std.all
##    .ENG1           0.269    0.104    2.600   0.009    0.269    0.406
```