**SYNTAX**

**Mplus (version 7.2)**

***### CONFIRMATORY FACTOR ANALYSIS ###***

TITLE: SWLS-5 – 1 FACTOR - CFA;

DATA: FILE IS swls5.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4 item5;

USEVARIABLES item1 item2 item3 item4 item5;

ANALYSIS:

ESTIMATOR=ML;

MODEL:

F by item1 item2 item3 item4 item5;

OUTPUT: TECH1 SAMPSTAT STDYX;

TITLE: SWLS-5 – 2 FACTORS - CFA;

DATA: FILE IS swls5.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4 item5;

USEVARIABLES item1 item2 item3 item4 item5;

ANALYSIS:

ESTIMATOR=ML;

MODEL:

F1 by item1 item2 item3;

F2 by item4 item5;

OUTPUT: TECH1 SAMPSTAT STDYX;

TITLE: SWLS-4 - CFA;

DATA: FILE IS swls4.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4;

USEVARIABLES item1 item2 item3 item4;

ANALYSIS:

ESTIMATOR=ML;

MODEL:

F by item1 item2 item3 item4;

OUTPUT: TECH1 SAMPSTAT STDYX;

TITLE: SWLS-3 - CFA;

DATA: FILE IS swls3.dat;

VARIABLE:

NAMES ARE item1 item2 item3;

USEVARIABLES item1 item2 item3;

ANALYSIS:

ESTIMATOR=ML;

MODEL:

F by item1 item2 item3;

OUTPUT: TECH1 SAMPSTAT STDYX;

***### MULTIPLEGROUP CONFIRMATORY FACTOR ANALYSIS – MEASUREMENT INVARIANCE ###***

TITLE: SWLS - Measurement invariance - GENDER

DATA: FILE IS data\_final.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4 item5 sex ageg4 ageg6 educ;

USEVARIABLES ARE item1 item2 item3 item4 item5;

GROUPING IS sex (1=M 2=F);

ANALYSIS:

ESTIMATOR=MLR;

MODEL = CONFIGURAL METRIC SCALAR;

MODEL:

F1 BY item1 item2 item3 item4 item5;

OUTPUT: tech1 sampstat;

TITLE: SWLS - Measurement invariance – AGE GROUPS

DATA: FILE IS data\_final.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4 item5 sex ageg4 ageg6 educ;

USEVARIABLES ARE item1 item2 item3 item4 item5;

GROUPING IS sex (1=M 2=F);

ANALYSIS:

ESTIMATOR=MLR;

MODEL = CONFIGURAL METRIC SCALAR;

MODEL:

F1 BY item1 item2 item3 item4 item5;

OUTPUT: tech1 sampstat;

TITLE: SWLS - Measurement invariance – AGE GROUPS - partial scalar;

DATA: FILE IS data\_final.dat;

VARIABLE:

NAMES ARE item1 item2 item3 item4 item5 sex ageg4 ageg6 educ;

USEVARIABLES ARE item1 item2 item3 item4 item5;

GROUPING IS ageg6 (1=g1 2=g2 3=g3 4=g4 5=g5 6=g6);

ANALYSIS:

ESTIMATOR=MLR;

MODEL:

F1 BY item1 item2 item3 item4 item5;

model g1:

[item4]

model g6:

[item4]

OUTPUT: tech1 sampstat modindices;

**R software (version 4.1.2)**

### SWLS-5

myirt <- mirt(swls5, 1, c('graded','graded','graded','graded','graded'))

coef(myirt, IRT = TRUE)

print(myirtSE)

summary(myirt)

# BIC, AIC

extract.mirt(myirt, "BIC")

extract.mirt(myirt, "AIC")

# confidence interval

myirtSE <- mirt(swls5, 1, rep("graded", 5), SE = TRUE)

coef(myirtSE, IRT = TRUE)

### SWLS-4

myirt4 <- mirt(swls4, 1, c('graded','graded','graded','graded'))

coef(myirt4, IRT = TRUE)

# BIC, AIC

extract.mirt(myirt4, "BIC")

extract.mirt(myirt4, "AIC")

# confidence interval

myirt4SE <- mirt(swls4, 1, rep("graded", 4), SE = TRUE)

coef(myirt4SE, IRT = TRUE)

### SWLS-3

myirt3 <- mirt(swls3, 1, c('graded','graded','graded'))

coef(myirt3, IRT = TRUE)

# BIC, AIC

extract.mirt(myirt3, "BIC")

extract.mirt(myirt3, "AIC")

# confidence interval

myirt3SE <- mirt(swls3, 1, rep("graded", 3), SE = TRUE)

coef(myirt3SE, IRT = TRUE)

## SWLS5 - 5 response categories

myirtr <- mirt(swls5r, 1, c('graded','graded','graded','graded','graded'))

coef(myirtr, IRT = TRUE)

summary(myirtr)

*### PLOTS*

## SWLS-5

item.1 <- extract.item (myirt, 1)

item.2 <- extract.item (myirt, 2)

item.3 <- extract.item (myirt, 3)

item.4 <- extract.item (myirt, 4)

item.5 <- extract.item (myirt, 5)

# Item information functions

theta <- seq(-4, 4, .01)

iteminfo.1 <- iteminfo(item.1, theta)

iteminfo.2 <- iteminfo(item.2, theta)

iteminfo.3 <- iteminfo(item.3, theta)

iteminfo.4 <- iteminfo(item.4, theta)

iteminfo.5 <- iteminfo(item.5, theta)

ymax <- max(c(iteminfo.1, iteminfo.2, iteminfo.3, iteminfo.4, iteminfo.5))

plot(theta, iteminfo.1, type = "l", col = "royalblue",

ylim = c(0, ymax), main = "Item Information Functions (SWLS-5)",

xlab = "Theta θ",

ylab = "Information", lty=1)

par(new = T)

plot(theta, iteminfo.2, type = "l", col = "seagreen4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2"),

col = c("royalblue", "seagreen4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo.3, type = "l", col = "orchid4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3"),

col = c("royalblue", "seagreen4", "orchid4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo.4, type = "l", col = "tan2",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3", "item 4"),

col = c("royalblue", "lightgreen", "orchid4", "tan2"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo.5, type = "l", col = "gray34",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3", "item 4", "item 5"),

col = c("royalblue", "seagreen4", "orchid4", "tan2", "gray34"),

lty = 1, cex = 0.6)

item4.1 <- extract.item (myirt4, 1)

item4.2 <- extract.item (myirt4, 2)

item4.3 <- extract.item (myirt4, 3)

item4.4 <- extract.item (myirt4, 4)

# Item information functions

theta <- seq(-4, 4, .01)

iteminfo4.1 <- iteminfo(item4.1, theta)

iteminfo4.2 <- iteminfo(item4.2, theta)

iteminfo4.3 <- iteminfo(item4.3, theta)

iteminfo4.4 <- iteminfo(item4.4, theta)

ymax <- max(c(iteminfo4.1, iteminfo4.2, iteminfo4.3, iteminfo4.4))

plot(theta, iteminfo4.1, type = "l", col = "royalblue",

ylim = c(0, ymax), main = "Item Information Functions (SWLS-4)",

xlab = "Theta θ",

ylab = "Information", lty=1)

par(new = T)

plot(theta, iteminfo4.2, type = "l", col = "seagreen4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2"),

col = c("royalblue", "seagreen4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo4.3, type = "l", col = "orchid4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3"),

col = c("royalblue", "seagreen4", "orchid4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo4.4, type = "l", col = "tan2",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3", "item 4"),

col = c("royalblue", "lightgreen", "orchid4", "tan2"),

lty = 1, cex = 0.6)

## SWLS-3

item3.1 <- extract.item (myirt3, 1)

item3.2 <- extract.item (myirt3, 2)

item3.3 <- extract.item (myirt3, 3)

# Item information functions

theta <- seq(-4, 4, .01)

iteminfo3.1 <- iteminfo(item3.1, theta)

iteminfo3.2 <- iteminfo(item3.2, theta)

iteminfo3.3 <- iteminfo(item3.3, theta)

ymax <- max(c(iteminfo3.1, iteminfo3.2, iteminfo3.3))

plot(theta, iteminfo3.1, type = "l", col = "royalblue",

ylim = c(0, ymax), main = "Item Information Functions (SWLS-3)",

xlab = "Theta θ",

ylab = "Information", lty=1)

par(new = T)

plot(theta, iteminfo3.2, type = "l", col = "seagreen4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2"),

col = c("royalblue", "seagreen4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, iteminfo3.3, type = "l", col = "orchid4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("item 1", "item 2", "item 3"),

col = c("royalblue", "seagreen4", "orchid4"),

lty = 1, cex = 0.6)

### Test information functions

theta <- seq(-4, 4, .01)

ymax <- max(c(tinfo5, tinfo4, tinfo3))

plot(theta, tinfo5, type = "l", col = "royalblue",

ylim = c(0, ymax), main = "Test Information Functions",

xlab = "Theta θ",

ylab = "Information", lty=1)

par(new = T)

plot(theta, tinfo4, type = "l", col = "seagreen4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("SWLS-5", "SWLS-4"),

col = c("royalblue", "seagreen4"),

lty = 1, cex = 0.6)

par(new = T)

plot(theta, tinfo3, type = "l", col = "orchid4",

ylim = c(0, ymax), xlab = "Theta θ",

ylab = "Information")

legend("topleft", legend = c("SWLS-5", "SWLS-4", "SWLS-3"),

col = c("royalblue", "seagreen4", "orchid4"),

lty = 1, cex = 0.6)

### Category response curves for SWLS-5

itemplot(myirt5, 1, "trace", main = "Category Characteristic Curves for Item 1",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5, 2, "trace", main = "Category Characteristic Curves for Item 2",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5, 3, "trace", main = "Category Characteristic Curves for Item 3",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5, 4, "trace", main = "Category Characteristic Curves for Item 4",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5, 5, "trace", main = "Category Characteristic Curves for Item 5",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

### Category response curves for SWLS-5 – recoded items

itemplot(myirt5r, 1, "trace", main = "Category Characteristic Curves for Item 1",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5r, 2, "trace", main = "Category Characteristic Curves for Item 2",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5r, 3, "trace", main = "Category Characteristic Curves for Item 3",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5r, 4, "trace", main = "Category Characteristic Curves for Item 4",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

itemplot(myirt5r, 5, "trace", main = "Category Characteristic Curves for Item 5",

theta\_lim = c(-4,4),

auto.key = list(space = "right", points = FALSE, lines = TRUE))

## Test Information and Standard Error

plot(myirt5, type = "infoSE", main = "Test Information and Standard Error",

theta\_lim = c(-4,4))

plot(myirt4, type = "infoSE", main = "Test Information and Standard Error",

theta\_lim = c(-4,4))

plot(myirt3, type = "infoSE", main = "Test Information and Standard Error",

theta\_lim = c(-4,4))

## Reliability score

theta\_se3 <- fscores(myirt3, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se3)

theta\_se3r <- fscores(myirt3r, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se3r)

theta\_se4 <- fscores(myirt4, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se4)

theta\_se4r <- fscores(myirt4r, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se4r)

theta\_se <- fscores(myirt5, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se)

theta\_se5r <- fscores(myirt5r, full.scores.SE = TRUE, QMC = TRUE)

empirical\_rxx(theta\_se5r)