Item Analysis for Rating Scale Items Using R

Companion Reading: Bandalos, p. 131-144

 # The dataset <ELS04 admin school climate.csv> shows responses of 657 US high school administrators to 12 survey items from the 2004 wave of the Education Longitudinal Study of 2002-2006. These items asked school principals to rate various aspects of school climate (e.g., how hard do students work?, is there much bullying/school violence?) Labels for each item are given below. The rating scale for each item ranged from 1 (not at all accurate) to 5 (very accurate); note that not all items have the same directionality – some are positively, and others negatively, phrased.

Name	Type	Width	Decimals	Label
stmorale	Numeric	3	0	Student morale is high
press	Numeric	3	0	Teachers press students to achieve
tcmorale	Numeric	3	0	Teacher morale is high
hilearn	Numeric	3	0	Learning is high priority for students
hwexpect	Numeric	3	0	Students expected to do homework
discipln	Numeric	3	0	Discipline is emphasized
structur	Numeric	3	0	Classroom activities are highly structured
negtchrs	Numeric	3	0	Many teachers are negative about students
lowmotiv	Numeric	3	0	Many teachers find it difficult to motivate students
academic	Numeric	3	0	Counselors/teachers encourage students to enroll in academic classes
conflict	Numeric	3	0	There is often conflict between teachers and administrators
indivlrn	Numeric	3	0	Teachers usually respond to students' individual needs

 # Import Excel .csv file

```
> ELSdata <- read.table("C:/Users/username/Desktop/ELS04 admin school climate items.csv",
header = TRUE, sep = ",")
```

 # The equivalent file pathname for Mac would be "/Users/username/Desktop/ELS04 admin school climate items.csv"

```
# Check that data imported correctly

> dim(ELSdata)

> colnames(ELSdata)
```

 # Use Revelle's 'psych' package to obtain descriptive statistics for items [after installing if necessary: *install.packages("psych")*]

```
# Activate the package

> require(psych)
```

```
# Generate sum total score for each administrator, after reverse-coding negatively-oriented items.

# Reverse-code Items 8, 9, and 11 on a rating scale with a minimum value of '1' and maximum value of '5'

> recodekey <- c(1,1,1,1,1,1,1,-1,-1,1,-1,1)

> recodedELSdata <- reverse.code(recodekey, ELSdata, mini=1, maxi=5)

# Create sum total score for each administrator with three items reverse-coded, so higher values (should) consistently indicate better school climate.  Save total score for later use (and verify that range of created variable values make sense).

> sumscore <- rowSums(recodedELSdata)

> summary(sumscore)


# Compute basic descriptive statistics for each item, examining minimum and maximum values and sample sizes to ensure data entry errors have not been made. Compute classical item "difficulty" (mean response value). Compute variability index (standard deviation) for each item.  May also report skewness value to characterize the extent of symmetry of each item's response distribution.

> describe(ELSdata)


# Produce unformatted frequency tables, and use to examine distribution of responses across each category for each item.

> lapply(ELSdata, table)

# Alternatively, print histograms displaying the response distribution for each item, for instance here, for the student morale item

> hist(ELSdata$stmorale)


# Ensure that item responses are recognized by the software as having ordinal scale

> ELSdata <- data.frame(lapply(ELSdata, factor, ordered=TRUE))


# Use Fox's 'polycor' package to compute item discrimination index and pairwise item correlations [after installing if necessary: install.packages("polycor")]

# Activate the package

> require(polycor)


# Append sum total score produced earlier to the raw item data set, and verify new column added

> ELSdata$sumscore <- sumscore

> colnames(ELSdata)
```

Compute item discrimination index (polyserial correlation between each item and the total scale score). The same command will also print polychoric correlations between pairs of items.

```
> hetcor(ELSdata, ML = FALSE, std.err = FALSE, use=c("pairwise.complete.obs"))
```

Examine the pattern of average total test scores (the mean column) **for persons in each response category for each item** (here, for example, the *stmorale* item). If rating scale is working well and sample is sufficiently large, mean total scores should increase across response categories for all items

```
> describeBy(ELSdata$sumscore,ELSdata$stmorale)
```