

Dynamic Item- and Teststatistics A shiny GUI for test development

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Requirements of the department

Over 70 different tests for psychological diagnostic (e.g. cognitive ability, language, occupational interests and more) are managed by the department and new tests are developed continually.

Standardized procedures may facilitate test development, thus a scientist can focus on project specific tasks and challenges.

Reproducibility and ease of use have to be core features of a statistic tool to meet different levels of experience with R and allow others to collaborate in a concrete test development procedure.

Overview & Input

choose data

filter data

items & grouping

measurement model

Options

report

load config

start data item stat item plot dyn item plot score stat dyn score stat reliability lavaan results sem results measurement invariance

Introduction

The problem

This app was developed because I needed a dynamic tool for item selection. I was facing the following problem:

- a bunch of test items have to be combined to a test
- item characteristics vary with the set of items i choose for the final test
- test characteristics change dynamically with the selected items
- all these problems appear for different subgroups

App features

The app is able to do a lot of stuff:

- filter your data to make a clean datasheet before analyzing
- set group variables to view results for every group
- item characteristics (difficulty, discrimination) as summary table, graphs and interactive graphs
- test-score distribution for the total group and every group level
- difference testing of the test-score (sum) between different group levels (including standardized differences)
- some analysis of reliability
- test of unidimensionality (1 PL, 2 PL)
- test of any other measurement model
- test for measurement invariance
- test for a specified structure equation model with the testscore (sum)

Updating the analysis by:

- choosing or reordering items
- changing data input or filter data
- selecting subgroups or reorder them
- loading an existing report (loads the state of the former report, too)
- or changing a relevant option of a current analysis

items & grouping

Items (info)

Choose items for evaluation

frj1i12bl frj1i7bl
frj1i16bl frj1i3bl
frj1i8bl frj1i14bl
frj1i18bl frj1i22bl
frj1i20bl frj1i21bl
frj1i24bl frj1i27bl
frj1i25bl frj1i26bl

load config

Load config from a former report (info)

select the RData-file from a former report

Browse... PFEGUI

Upload complete

Group 1 (info)

first grouping variable (optional)

Bildung

Subset group 1?

Select which levels to use.

LFS HSA MSA

Options

Data (info)

Select which data to show in data panel.

complete data
 filtered data

filter data

Filter 1 readme

Select filter variable 1

Geschlecht

Choose the variable levels you want to keep.

männlich

Filter date range (info)

Choose the date variable.

bwtrwb1dat

Filter on a time interval

17-06-26 to 2017-06-

Filter manually (info)

TESTSCORE (info)

Select the function for the composite score

sum
 mean

Select how to treat missings on the items

ignore
 as false
 use

Output

item plot

The panel *item plot*:

- shows a graph of discrimination and difficulty parameter for each selected item
- ... in the order of the selected items
- ... for each selected group (and group level)

score stat

The panel *score stat*:

- shows the distribution of the testscore which is the sum of itemscores (ignoring missings)
- can be viewed as relative barplot or density
- shows the results of difference tests (t-tests)
- ... and a standardized mean difference between group levels

N1	N2	h1	h2	M1	M2	SD1	SD2	cohens_d
1826	5061	0.167	0.462	6.441	8.221	2.904	2.987	0.600
5061	2443	0.462	0.223	8.221	10.146	2.987	2.691	0.665

Distribution of testscore

reliability

The panel *reliability*:

- shows some parameter of reliability (unidimensional) and omega (4 factors)
- shows an indicator of model fit
- everything for each level of all specified groups

group	N	NItems	rmsea	alpha	G2	omegat
LFS	1826	14	0.03	0.69	0.69	0.69
HSA	5061	14	0.04	0.73	0.73	0.73
MSA	2443	14	0.03	0.73	0.73	0.73

lavaan results

The panel *lavaan results*:

- shows the results of the applied measurement model
- uses the lavaan package and syntax
- changes directly, when items are added

measurement invariance

The panel *measurement invariance*:

- shows the result of measurement invariance tests
- uses the appropriate function of the semTools package

Model and general options.

Testing unidimensionality with CFA.

Treat items as categorical.

Constrain all intercepts or thresholds (categorical) to be equal.

Constrain all loadings to be equal.

Additional analysis:

Apply MGCFA with test of measurement invariance. (info)

Choose the group variable for MGCFA

Bildung_group1
 Geschlecht_group2

Apply SEM to the test score?

report

Report (info)

include item stat

include item plot

include score stat

include reliability

include lavaan results

include sem results

include measurement invariance

It is possible to include your analysis in a report (word-file). Just select which parts of the output panels you would like to see in the report. This capability allows reproducible research.

- Select the results you want to include in the report
- Choose which group to include and their order

the report:

- consists of a word file (the report), the corresponding markdown file and a RData-file (with the data frame and an input-object) in a zip-archive
- can be replicated by executing the markdown file in R(Studio)
- incorporates all your settings from the PFE-GUI into the analysis
- can be adapted by changing the parameters in the input-object (see RData-file)

Note: all examples are based on simulated data

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