

Digital Learning Forum

Data Analytics and Online Learning

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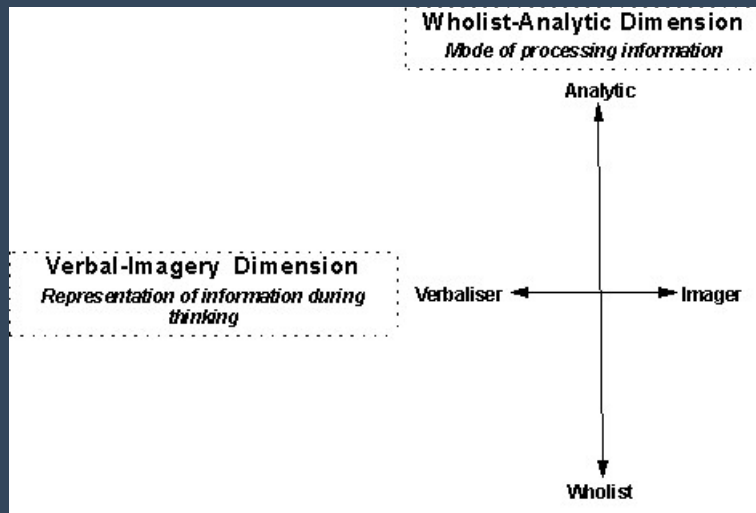
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Data Analytics and Online Learning

- **Relationship between Data Analytics and Online Learning**
- **Psychometric Testing**
- **Overview of a Research Project**
- **Methodology**
- **Analysis and Results**
- **Conclusions**

Important Relationship

- Data Analytics
- Online Learning



Riding & Cheema, 1991)

Being There

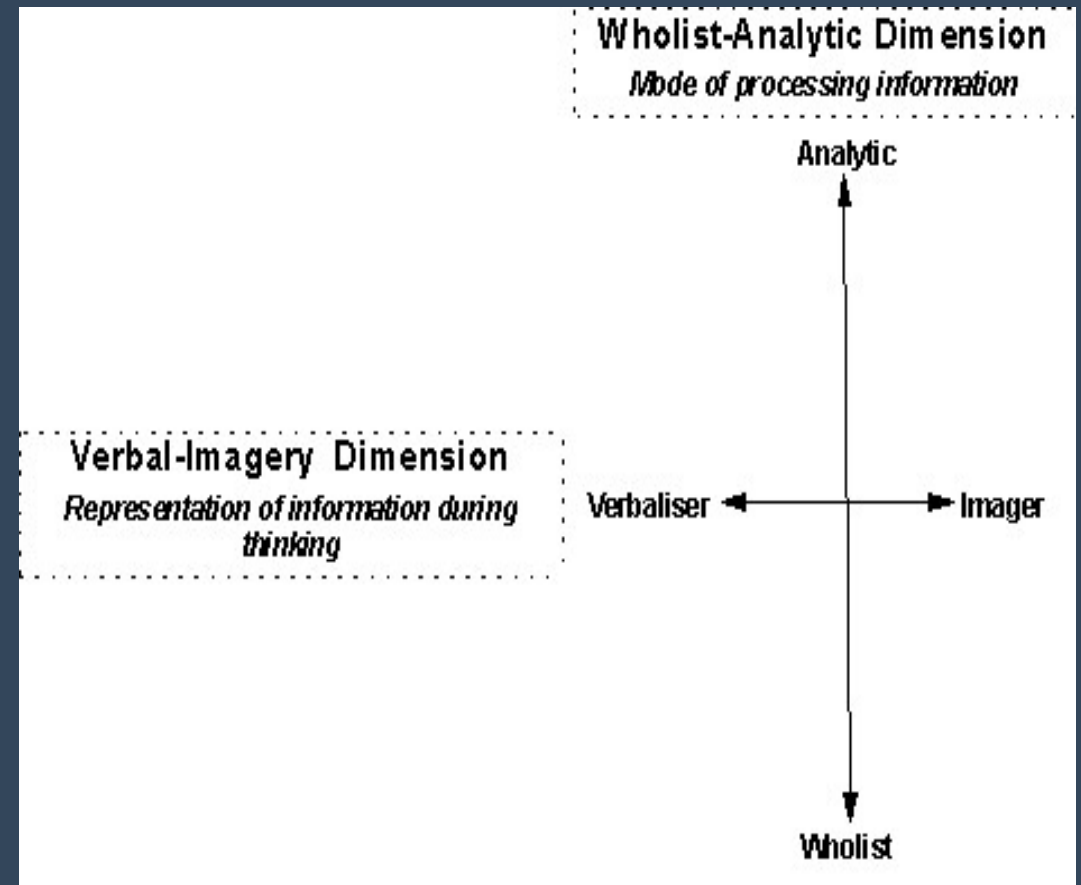


Woerner, 2019

Important Relationship

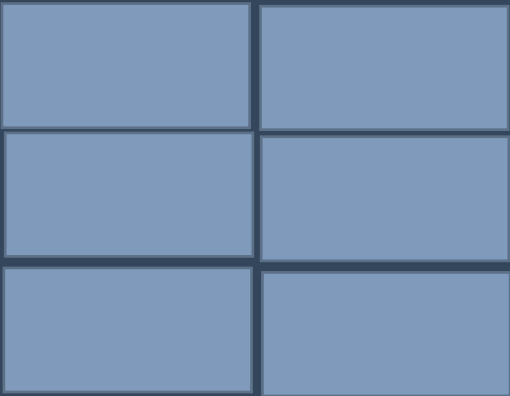
- **Data Analytics** (also known as 'data analysis')

Complex intellectual capabilities and personality traits



Important Relationship

- **Data Analytics**



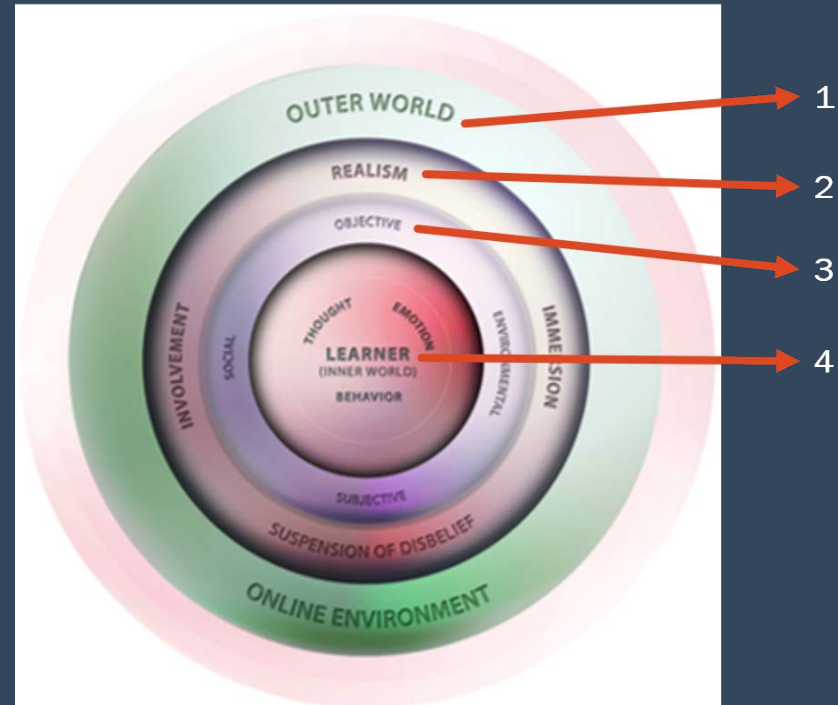
Wholist view



Analytic view

Important Relationship

- **Online Learning
Being There**



Psychometric Testing

Measures a person's suitability for a role based on their intellectual capabilities and personality traits.

Social Sciences refers to these properties as constructs, attributes and traits.

This methodology offers an effective tool for understanding individual of differences in digital skill development.

RUMM2030 Project Summary Statistics Screen

ITEM - PERSON INTERACTION

ITEMS		PERSONS	
	Location		Fit Residual
Mean	0.0000	Mean	0.3776
Std Dev	0.4995	Std Dev	1.1148
Skewness	-0.7233	Skewness	0.4441
Kurtosis	-0.2404	Kurtosis	1.0447
Correlation [location/stdResidual]		0.1330	

	Location		Fit Residual
Mean	1.3814	Mean	-0.2864
Std Dev	1.0075	Std Dev	1.4830
Skewness	2.1463	Skewness	-0.5322
Kurtosis	6.3417	Kurtosis	0.1992
Correlation [location/stdResidual]		0.1131	

☒ Include Extremes N = 334

ITEM - TRAIT INTERACTION

Total - Item Chi Square	131.2703
Degrees of Freedom	76
Chi Square Probability	0.000089

RELIABILITY INDICES

PerSepIdc	TU4
* with extms	0.89075
* NO extms	0.87232
CoefficAlpha	
* with extms	0.86936
* NO extms	0.85207

LIKELIHOOD RATIO TEST

Analysis	Likelihood	ChiSq
anaName1		
anaName2		

	DegF	Prob

POWER OF ANALYSIS OF FIT

Excellent
Good
Reasonable
Low
Too Low

EXCELLENT

This display is intended as a guide ONLY and should be used in conjunction with other analysis indicators

< Display Control

File Text Format
☒ Fixed ☐ Tab Delmit

Psychometric Testing

Output display specifications

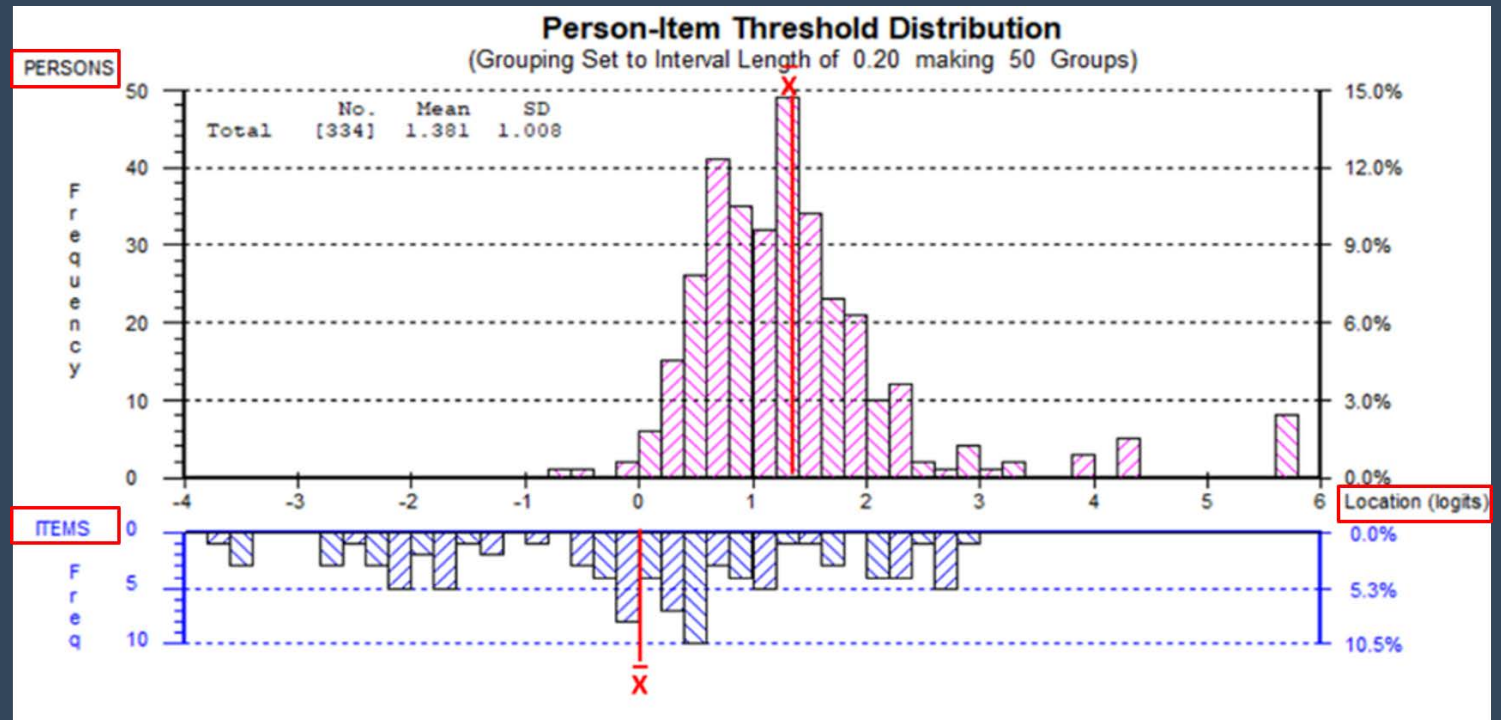
DISPLAY SPECIFICATIONS for FITPED8: FITPED final Run - extremes removed

Item Parameter Details <ul style="list-style-type: none"><input type="radio"/> Thresholds<input type="radio"/> Category Frequencies<input type="radio"/> Principal Components [Guttman structure]<input type="radio"/> Sufficient Statistics<input type="radio"/> Dimensionality	Test-of-Fit Details <ul style="list-style-type: none"><input type="radio"/> Summary Statistics<input type="radio"/> Individual Item Fit<input type="radio"/> Individual Person Fit<input type="radio"/> Residual Correlations<input type="radio"/> Residual Principal Components<input type="radio"/> Item Facet Tests<input type="radio"/> Tailored Test Analysis	Complete Data Only <ul style="list-style-type: none"><input type="radio"/> Person Sufficient Statistics<input type="radio"/> Alpha statistics Guttman Pattern <ul style="list-style-type: none"><input type="radio"/> Overall Item Categorisation <ul style="list-style-type: none"><input type="radio"/> Scoring structure<input type="radio"/> Class interval structure	Item Characteristics <ul style="list-style-type: none"><input type="radio"/> Category Probability Curves<input type="radio"/> Item Characteristics Curves ICC [for DIF analyses]<input type="radio"/> Threshold Probability Curves<input type="radio"/> MC Distractor Curves																		
Analysis Model <ul style="list-style-type: none"><input checked="" type="radio"/> Full Model [Location, Unit, Skewness and Kurtosis]<input type="radio"/> Full Model [Location, Unit and Skewness]<input type="radio"/> Full Model [Location and Unit]<input type="radio"/> Full Model [Location only] <ul style="list-style-type: none"><input type="radio"/> Equal Kurtosis<input type="radio"/> Equal Skewness<input type="radio"/> Equal Unit			Further Outputs <ul style="list-style-type: none"><input type="radio"/> Person-Item Distribution<input type="radio"/> Threshold Map<input type="radio"/> Item Map<input type="radio"/> Equating Tests / t-tests<input type="radio"/> Conditional Test-of-fit<input type="radio"/> Residual Statistics Distributions																		
Sample Adjustments - for Test-of-Fit statistics <table border="1"><tr><td colspan="2">Sample Sizes</td><td colspan="2">Amend Sample Size</td><td rowspan="2">Create Adjusted Chi Squ</td><td rowspan="2">Recover Original Chi Squ</td><td rowspan="2">Current Fit Estimates using Original Set Sample Size</td></tr><tr><td>actual</td><td>15</td><td></td><td>15</td></tr><tr><td>adjusted</td><td>15</td><td colspan="2"><input type="text" value="15"/> <input type="button" value="Accept New Size"/></td><td colspan="3"></td></tr></table>				Sample Sizes		Amend Sample Size		Create Adjusted Chi Squ	Recover Original Chi Squ	Current Fit Estimates using Original Set Sample Size	actual	15		15	adjusted	15	<input type="text" value="15"/> <input type="button" value="Accept New Size"/>				
Sample Sizes		Amend Sample Size		Create Adjusted Chi Squ	Recover Original Chi Squ	Current Fit Estimates using Original Set Sample Size															
actual	15		15																		
adjusted	15	<input type="text" value="15"/> <input type="button" value="Accept New Size"/>																			

< Analysis Control < Main Menu Display

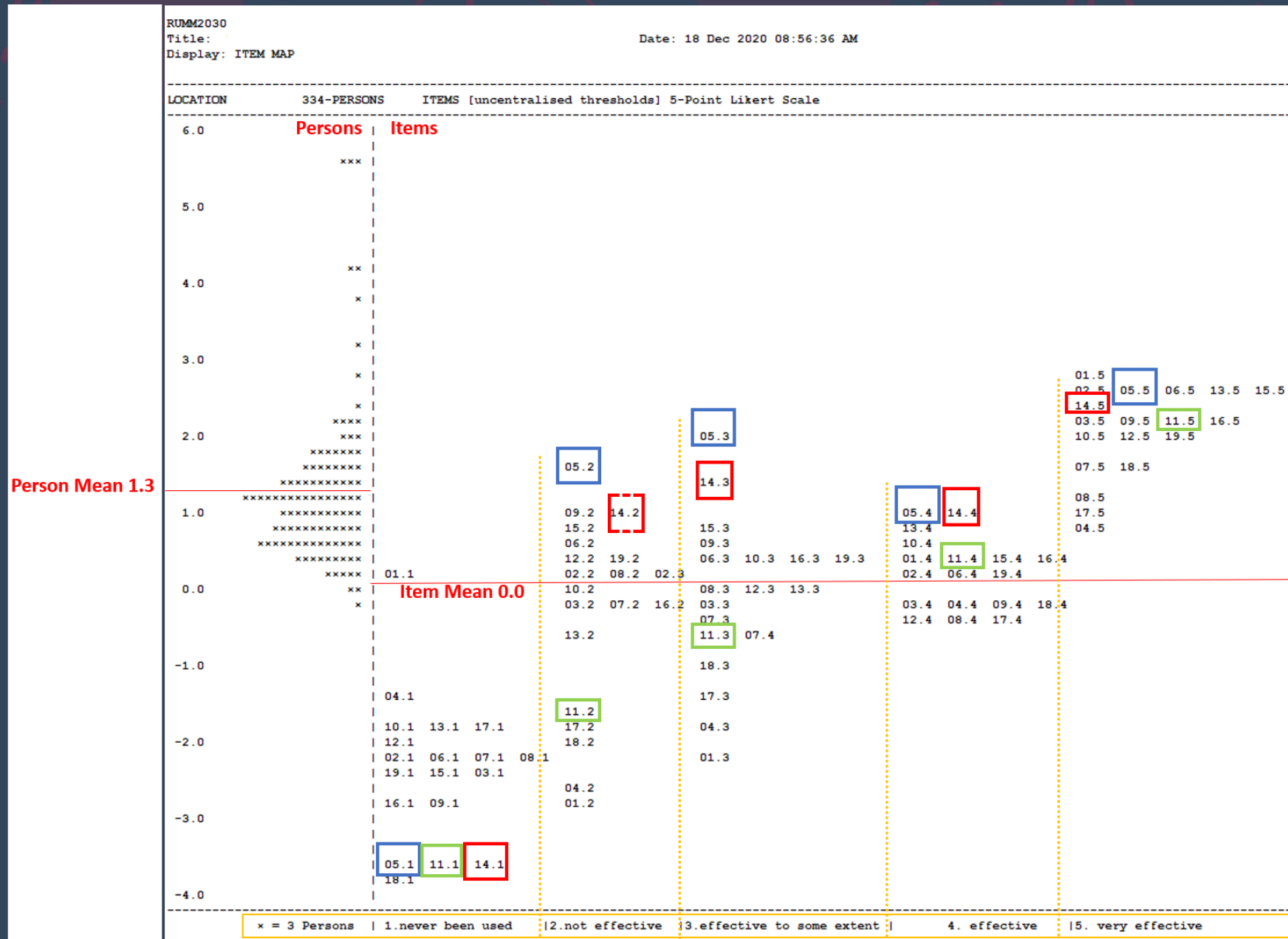
Psychometric Testing

The proverb that a picture speaks a thousand words is used here to communicate the initial research results.

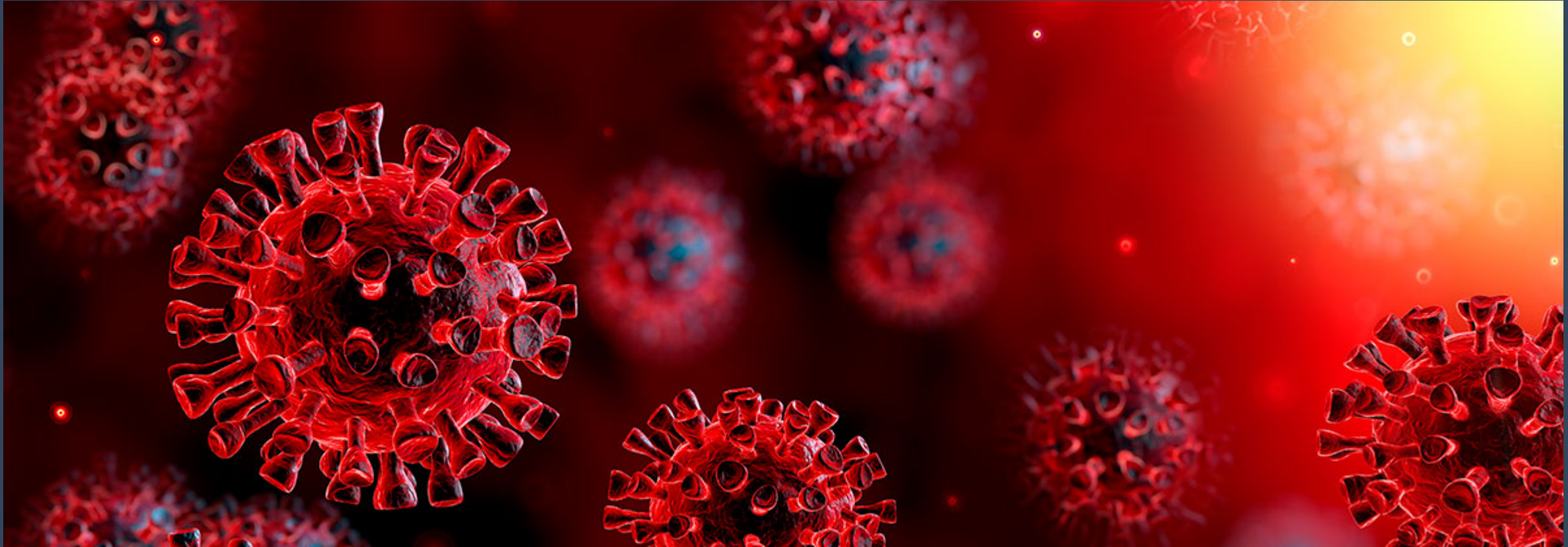


Psychometric Testing

Both people and test-items displayed along the Logit-Scale.



Overview of Research Project





Method

A two staged approach

Semi-structured interviews (qualitative)

Questionnaire/Survey (quantitative)

Participants

higher education instructors and students
working or enrolled at a higher education
institution

Analysis and Results - participants

- College/School Distribution

Group	# Partic	Mean	SD	Skew
4	12	0.939	0.551	-0.112
5	8	0.849	0.724	-1.095
9	289	1.438	1.011	2.112
10	9	0.875	0.636	0.514
11	6	0.899	0.385	2.363
Total Sample	334	1.381	1.0075	2.146

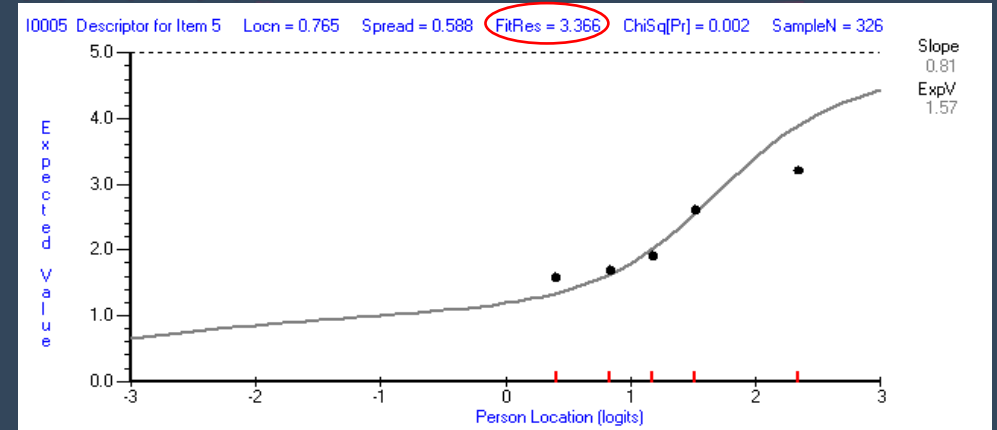
- Variation between Gender

Group	# Partic	Mean	SD	Skew
Males	127	1.426	0.921	1.074
Females	199	1.184	0.633	1.096
Total Sample	334	1.381	1.0075	2.146

Analysis and Results – Test-items

- Test-item characteristic curves

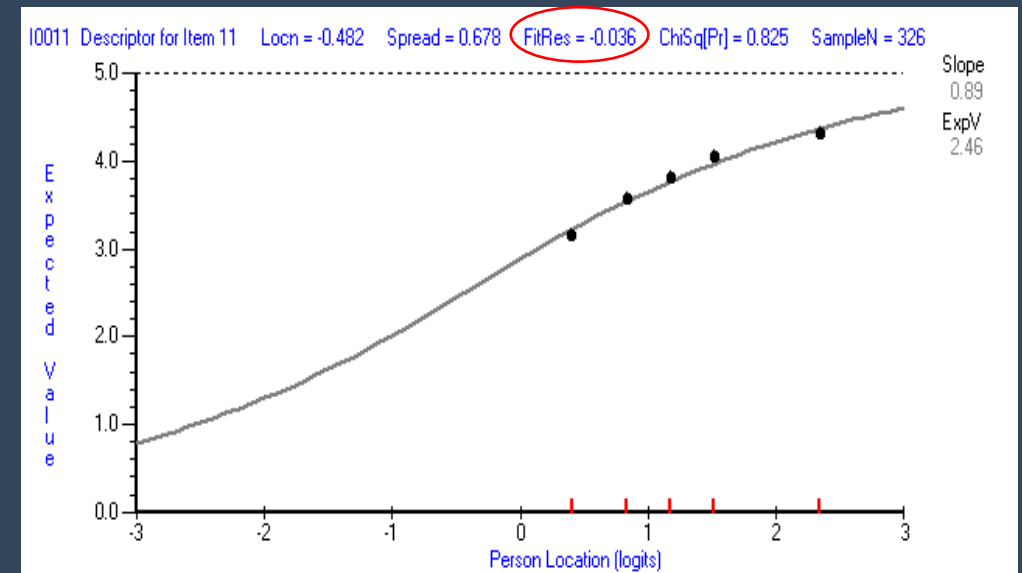
The Rasch item characteristic curves identify class intervals that show the relative ability of an item to discriminate among adjoining knowledge constructs (traits) along a liner scale. Rather than compare individual participant scores against the expected model curve, the Rasch Model divides the sample into quartiles, or in this case quintiles. So it determines the mean logit score of each 20% of the participant sample. These means are 0.402, 0.835, 1.175, 1.518 and 2.344. As you will see in the expected value plots for individual questions, these red marks on the person logit scale do not change. However the observed value of the group (see the black dots within the plot) does change for each question.



- Some items have irregular distributions and poor correlation to the model's expected curve. Item-5 for instance, (seeking agreement on *the use of cameras in online communications*) showed a relatively poor correlation with a fit-residual of 3.366, with the lowest quintile scoring above the model curve and the highest quintile scoring well below the expected curve.

Analysis and Results – Test-items

- Test-item characteristic curves
- Item-11, which asked the participants for agreement on *the strategy of allowing direct questions during virtual lectures*, illustrates that the observed score for each quintile very closely matches the expected value from the model's distribution (i.e. all black dots are very close to the expected value curve). Note, the fit-residual is very low at only -0.036 indicating a strong correlation between the observed scores and the model's expected values.

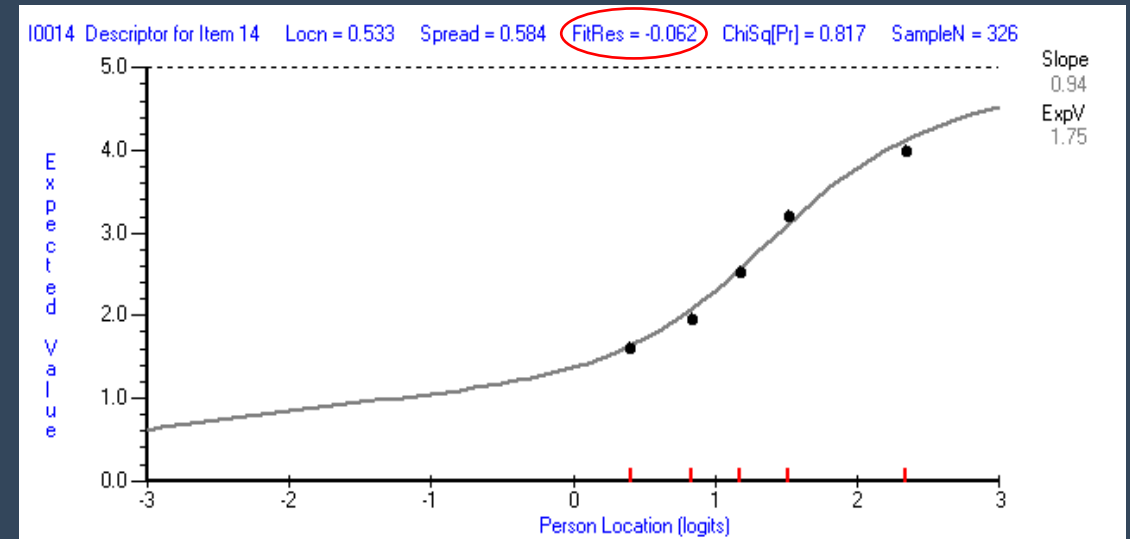


Analysis and Results – Test-items

- Test-item characteristic curves

The item characteristic curve for item-14 also illustrates a relatively good correlation to the model's expected value curve, with a small fit-residual of -0.062. This illustrates the need for the researcher to evaluate all the available data.

This item was seeking agreement on *additional lectures (unscheduled)*.



Conclusions

Always strive for an understanding of the importance of the interactive relationship between data analytics and online learning.

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