Testing and Visualizing the Dimensionality of Rating Scale Data

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Sept 20th, 2023

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Testing and Visualizing the Dimensionality of Rating Scale Data

- The item-level rating scales in course evaluation surveys generally constitute several distinct but interrelated **Dimensions of Effective Teaching.**

- These dimensions are not just theoretical. They can be statistically derived using **Factor Analysis.**

- When reviewing an existing survey or piloting a new survey, a factor analysis can answer several important questions about the **validity of the data:**

  - Which item-level scales group together around common themes?

  - Does my survey capture all the dimensions commonly found in course evaluation surveys?

  - Does my survey include any dimensions beyond what is most common?

- To statistically derive dimensionality demonstrates that **students take the surveys seriously** and can differentiate between distinct types of teaching behaviors and student experiences – if only at a subconscious level.

  - Does my survey reflect **how students think about "good teaching?"**

  - Understanding this dimensional structure can help instructors develop more targeted approaches to improve their teaching.

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Clarity and Organization

- Organizes and plans the course effectively
- Uses class time effectively
- Makes the goals of the course clear
- Explains course material clearly
- Is clear about instructions for assignments

Interaction and Rapport

- Encourages students to ask questions
- Interacts effectively with the students
- Treats students in a respectful manner
- Is enthusiastic about the subject
- Is available for help outside of class
- Responds effectively to student questions

Grading and Assignments

- Grades student work fairly.
- Employs relevant tests/graded materials
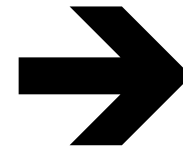- Provides helpful feedback on student work

Student Engagement

- I found the course intellectually stimulating
- I learned a great deal in this course

Simplify a Large Correlation Matrix

How strongly is each scale related to the group as a whole?

Pearson Correlations (*r*): 21 Scales → 210 Pairwise Comparisons

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1		.03	.03	.03	.02	-.02	.06	.04	.03	-.01	-.01	.00	.02	-.03	-.02	.39	.17	.13	.12	.17	.07
2	.03		.77	.71	.61	.49	.50	.51	.51	.65	.71	.65	.60	.54	.59	.27	.52	.22	.25	.55	.27
3	.03	.77		.68	.61	.48	.48	.50	.49	.60	.68	.63	.58	.52	.57	.28	.52	.22	.24	.55	.27
4	.03	.71	.68		.65	.52	.53	.54	.53	.69	.71	.65	.63	.57	.61	.25	.52	.23	.26	.56	.28
5	.02	.61	.61	.65		.67	.57	.66	.60	.59	.68	.74	.65	.58	.56	.21	.51	.22	.24	.53	.29
6	-.02	.49	.48	.52	.67		.54	.54	.53	.50	.52	.62	.54	.56	.51	.15	.38	.20	.20	.39	.28
7	.06	.50	.48	.53	.57	.54		.58	.50	.52	.53	.58	.59	.51	.50	.25	.41	.21	.23	.43	.28
8	.04	.51	.50	.54	.66	.54	.58		.62	.51	.57	.63	.59	.50	.51	.22	.46	.23	.24	.46	.30
9	.03	.51	.49	.53	.60	.53	.50	.62		.51	.55	.59	.53	.49	.51	.22	.45	.25	.23	.45	.30
10	-.01	.65	.60	.69	.59	.50	.52	.51	.51		.74	.66	.65	.60	.61	.21	.47	.19	.23	.51	.26
11	-.01	.71	.68	.71	.68	.52	.53	.57	.55	.74		.77	.68	.61	.64	.20	.54	.21	.26	.58	.29
12	.00	.65	.63	.65	.74	.62	.58	.63	.59	.66	.77		.72	.62	.62	.22	.52	.22	.25	.55	.30
13	.02	.60	.58	.63	.65	.54	.59	.59	.53	.65	.68	.72		.69	.63	.24	.50	.21	.25	.54	.29
14	-.03	.54	.52	.57	.58	.56	.51	.50	.49	.60	.61	.62	.69		.70	.14	.45	.19	.23	.48	.28
15	-.02	.59	.57	.61	.56	.51	.50	.51	.51	.61	.64	.62	.63	.70		.19	.48	.21	.24	.52	.29
16	.39	.27	.28	.25	.21	.15	.25	.22	.22	.21	.20	.22	.24	.14	.19		.45	.26	.24	.42	.23
17	.17	.52	.52	.52	.51	.38	.41	.46	.45	.47	.54	.52	.50	.45	.48	.45		.30	.32	.80	.31
18	.13	.22	.22	.23	.22	.20	.21	.23	.25	.19	.21	.22	.21	.19	.21	.26	.30		.47	.33	.30
19	.12	.25	.24	.26	.24	.20	.23	.24	.23	.23	.26	.25	.25	.23	.24	.24	.32	.47		.38	.29
20	.17	.55	.55	.56	.53	.39	.43	.46	.45	.51	.58	.55	.54	.48	.52	.42	.80	.33	.38		.33
21	.07	.27	.27	.28	.29	.28	.28	.30	.30	.26	.29	.30	.29	.28	.29	.23	.31	.30	.29	.33	

Initial Communalities

Scale	h^2
Explains course material clearly	.74
Responds effectively to student questions	.73
I learned a great deal in this course	.70
Interacts effectively with the students	.69
Organizes and plans the course effectively	.69
I found the course intellectually stimulating	.67
Makes the goals of the course clear	.66
Provides helpful feedback on student work	.66
Uses class time effectively	.65
Is clear about instructions for assignments	.63
Grades student work fairly	.62
Employs relevant tests/graded materials	.60
Encourages students to ask questions	.57
Treats students in a respectful manner	.54
Is enthusiastic about the subject	.50
Is available for help outside of class	.49
Hard work is required to get good grades	.35
I kept up with the assigned work	.30
I attended most class sessions	.28
To my knowledge these was no cheating	.20
Hours a week outside of class [spent] doing work	.18

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How Many Dimensions are Represented by Those 16 Scales?

Which scales group together *statistically*? – and what do those groups represent *psychologically*?

Scree Plot
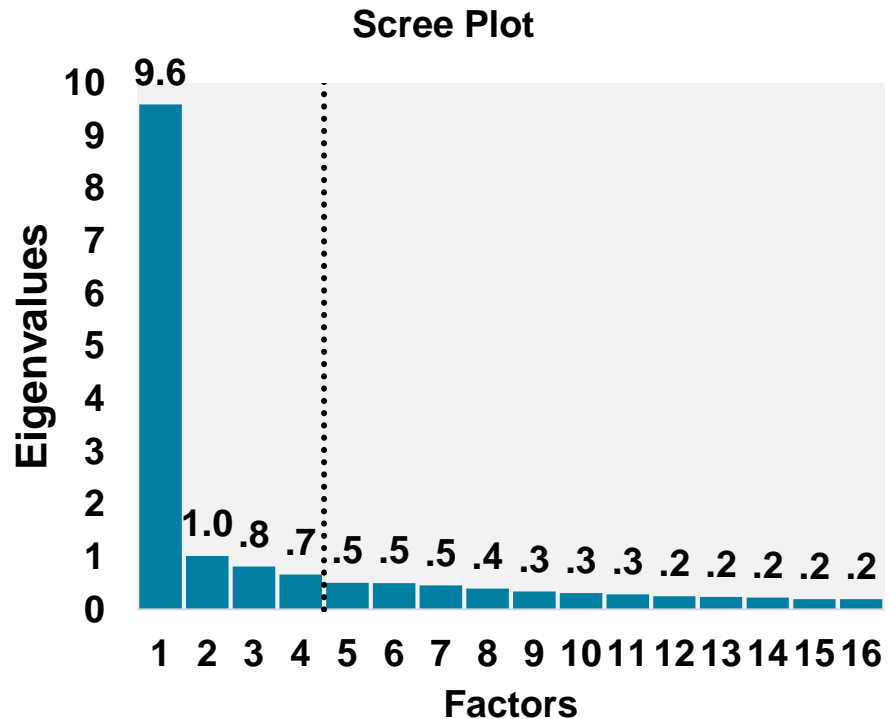
Factor Loadings (Pattern Matrix)

Scale	Interaction and Rapport	Student Engagement	Clarity and Organization	Grading Fairness
Encourages students to ask questions	**.83**	.05	.05	.06
Interacts effectively with the students	**.80**	.02	.12	.06
Treats students in a respectful manner	**.74**	.07	.04	.10
Is enthusiastic about the subject	**.66**	.08	.04	.03
Is available for help outside of class	**.57**	.02	.03	.12
Responds effectively to student questions	**.54**	.01	.25	.12
I found the course intellectually stimulating	.02	**.92**	.04	.02
I learned a great deal in this course	.02	**.84**	.05	.05
Organizes and plans the course effectively	.03	.01	**.90**	.02
Uses class time effectively	.02	.05	**.82**	.05
Makes the goals of the course clear	.12	.06	**.61**	.10
Explains course material clearly	.19	.06	**.54**	.15
Is clear about instructions for assignments	.08	.00	**.51**	.30
Grades student work fairly	.07	.08	.03	**.79**
Employs relevant tests/graded materials	.01	.10	.22	**.56**
Provides helpful feedback on student work	.30	.08	.13	**.42**

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Impact on Reporting

Keep It Simple
From statistics to wording to colors, reports must be easy to understand for instructors across a wide range of technical knowledge and years of experience.

Villanova Uses Explorance Blue
With a bit of custom coding (HTML/CSS), each item-level scale is marked with a color-coded icon corresponding to its **Dimension of Effective Teaching.** At the top, the legend provides basic information about the Dimensions.

No, We Do Not Calculate "Index Scores"
Every item-level scale is important for an instructor to consider. Including a dimension-level average for, say, Clarity and Organization would encourage instructors to ignore those individual items. Every design choice should increase – *not decrease* – engagement and interest in the report.

Dimensions of Effective Teaching

Most item-level CATS scales comprise distinct but interrelated dimensions of a general effective teaching trait. These dimensions are all strongly correlated with the global-level scale for **Quality of Instruction**, while the global-level **Overall Value** scale is primarily correlated with the *Student Engagement* dimension.

- CO Clarity and Organization
- GF Grading Fairness
- OCM Online Classroom Management ⓘ
- IR Interaction and Rapport
- SE Student Engagement

Rank and Tenure

R&T denotes scales reported in the summary of CATS results included in dossiers for tenure and promotion candidates.

For more information, see the Rank and Tenure Policy and Guidelines.

Show labels ▶	1	2	3	4	5	Avg.	Dept. Avg.	Dept. 75th	Dept. 50th	Dept. 25th	Coll. Avg.	Coll. 75th	Coll. 50th	Coll. 25th
Hours per week worked outside of class.	14	11	3			1.6	1.6	1.8	1.6	1.3	1.7	2.0	1.7	1.4

The instructor for this course...	Show labels ▶	5	4	3	2	1	Avg.	Dept. Avg.	Dept. 75th	Dept. 50th	Dept. 25th	Coll. Avg.	Coll. 75th	Coll. 50th	Coll. 25th
Organizes and plans the course effectively.	CO	20	10				4.7	4.5	4.8	4.6	4.5	4.6	4.9	4.7	4.5
Uses class time effectively.	CO	25	5				4.8	4.5	4.8	4.6	4.5	4.6	4.8	4.7	4.4
Makes the goals of the course clear.	CO	23	4	2	1		4.6	4.6	4.8	4.7	4.5	4.6	4.9	4.7	4.4
Interacts effectively with the students.	IR	22	5	2	1		4.6	4.7	4.9	4.8	4.6	4.7	4.9	4.8	4.5
Treats students in a respectful manner.	IR	26	3			1	4.8	4.8	4.9	4.8	4.7	4.8	5.0	4.8	4.7
Is available for help outside of class.	IR	13	12	5			4.3	4.7	4.9	4.7	4.6	4.6	4.9	4.7	4.5
Encourages students to ask questions and participate.	IR	23	5	1	1		4.7	4.8	4.9	4.8	4.7	4.7	5.0	4.8	4.6
Is enthusiastic about the subject.	IR	26	4				4.9	4.9	4.9	4.9	4.8	4.8	5.0	4.9	4.8
Is clear about instructions for assignments.	CO	21	8	1			4.7	4.6	4.8	4.6	4.4	4.5	4.8	4.7	4.4
Explains course material clearly.	CO	20	8	2			4.6	4.6	4.8	4.7	4.4	4.6	4.9	4.7	4.4
Responds effectively to student questions.	IR	22	6	2			4.7	4.7	4.9	4.8	4.6	4.7	4.9	4.8	4.5
Provides helpful feedback on student work.	GF	15	6	5	4		4.1	4.6	4.8	4.7	4.4	4.6	4.9	4.7	4.4
Grades student work fairly.	GF	20	9	1			4.6	4.6	4.9	4.7	4.6	4.6	4.9	4.7	4.4
Employs tests/graded materials relevant to course content.	GF	21	7	1	1		4.6	4.7	4.9	4.8	4.6	4.7	4.9	4.8	4.5

Discuss your own work in this course...	Show labels ▶	5	4	3	2	1	Avg.	Dept. Avg.	Dept. 75th	Dept. 50th	Dept. 25th	Coll. Avg.	Coll. 75th	Coll. 50th	Coll. 25th
Hard work is required to get good grades in this course.	R&T	16	8	4	1	1	4.2	4.3	4.6	4.2	4.1	4.3	4.6	4.4	4.1
I found the course intellectually stimulating.	SE | R&T	20	10				4.7	4.5	4.8	4.6	4.3	4.5	4.8	4.5	4.3
I attended most class sessions.		22	7	1			4.7	4.7	4.9	4.8	4.6	4.7	4.9	4.8	4.7
I kept up with the assigned work.		21	8	1			4.7	4.7	4.8	4.7	4.5	4.7	4.9	4.8	4.6
I learned a great deal in this course.	SE | R&T	22	8				4.7	4.5	4.8	4.7	4.4	4.5	4.8	4.6	4.3
To my knowledge there was no cheating in this class.		24	4	1			4.8	4.7	4.9	4.8	4.6	4.8	4.9	4.8	4.7

Provide an Overall Evaluation of this course...	Show labels ▶	5	4	3	2	1	Avg.	Dept. Avg.	Dept. 75th	Dept. 50th	Dept. 25th	Coll. Avg.	Coll. 75th	Coll. 50th	Coll. 25th
Quality of Instruction.	CO IR GF OCM SE | R&T	21	8	1			4.7	4.6	4.8	4.6	4.4	4.6	4.8	4.7	4.4
Overall Value.	SE CO OCM IR GF | R&T	18	10	1	1		4.5	4.5	4.8	4.6	4.5	4.5	4.8	4.6	4.2

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