Addendum to Transforming Rubrics Using Factor Analysis

This addendum covers ETSU's Assessment rubrics not discussed in Baryla, Shelley, & Trainor (2012).

Baryla, Ed, Shelley, Gary and William Trainor (2012). Transforming Rubrics Using Factor Analysis. *Practical Assessment, Research & Evaluation*, 17(3). Available online: http://pareonline.net/getvn.asp?v=17&n=3

Two additional references that we highly suggest for background in dealing with rubric development are:

1) Popham, W. J. (1997). What's wrong and what's right with rubrics. *Educational Leadership*, Vol. 55 (2) 72-75

2) Association of American Colleges and Universities, at http://www.aacu.org/value/rubrics
Oral Communication: http://www.aacu.org/value/rubrics/pdf/OralCommunication.pdf
Written: http://www.aacu.org/value/rubrics/pdf/WrittenCommunication.pdf
Critical Thinking: http://www.aacu.org/value/rubrics/pdf/CriticalThinking.pdf
Teamwork: http://www.aacu.org/value/rubrics/pdf/teamwork.pdf
Ethical Reasoning: http://www.aacu.org/value/rubrics/pdf/EthicalReasoning.pdf

Results below are for the written, critical thinking, ethics, and teamwork rubrics. No attempt is made to determine what the underlying factors are. Only the number of likely factors is given and which criteria map to each factor.

A. Written Rubric:

For the Written rubric, 40 criteria are examined excluding the final overall assessment question due to the fact the last question is not related to any particular single underlying criterion. This method is applied to the other rubrics as well.

The first 10 Eigenvalues based on Principle Components are listed in Table 1.

Table 1: First 10 Eigenvalues, Written

	Eigenvalue	Difference	Proportion	Cumulative
1	24.70	22.74	0.62	0.62
2	1.96	0.18	0.05	0.67
3	1.77	0.25	0.04	0.71
4	1.52	0.60	0.04	0.75
5	0.92	0.03	0.02	0.77
6	0.89	0.20	0.02	0.79
7	0.69	0.06	0.02	0.81
8	0.64	0.11	0.02	0.83
9	0.52	0.03	0.01	0.84
10	0.49	0.03	0.01	0.85

Based on Kaiser's criteria, four factors are retained. The rotated factor pattern using maximum liklihood and the promax oblique rotation is displayed in Table 2. Those questions that group together are in bold for each column.

Table 2: Written Rotated Factor Pattern

Criterion	Factor1	Factor2	Factor3	Factor4
1	0.23	0.01	-0.02	**0.68**
2	0.24	0.02	-0.02	**0.68**
3	0.00	0.10	0.03	**0.85**
4	0.02	0.03	0.00	**0.91**
5	0.05	0.07	0.03	**0.73**
6	0.05	0.07	0.08	**0.71**
7	**0.72**	-0.11	0.14	0.12
8	**0.86**	-0.06	0.00	0.05
9	**0.77**	0.07	-0.05	0.11
10	0.23	**0.27**	0.19	0.19
11	0.21	**0.33**	0.24	0.16
12	0.25	0.08	**0.47**	0.15
13	0.25	0.11	**0.45**	0.19
14	**0.50**	0.19	0.16	0.16
15	**0.33**	0.15	0.32	0.18
16	**0.63**	0.04	0.21	0.06
17	**0.75**	-0.05	0.16	-0.03
18	**0.48**	-0.24	0.44	0.07
19	**0.59**	0.27	0.06	0.01
20	**0.70**	0.09	0.07	0.09
21	**0.46**	0.26	0.11	0.17
22	**0.55**	0.29	0.04	0.08
23	**0.69**	0.29	-0.08	0.02
24	**0.60**	0.30	-0.01	0.07
25	**0.44**	0.25	-0.01	0.08
26	0.17	-0.17	**0.77**	0.03
27	0.02	0.09	**0.71**	0.07
28	-0.05	0.40	**0.61**	0.00
29	0.27	0.21	**0.59**	-0.21
30	-0.09	0.21	**0.74**	0.12
31	0.05	0.14	**0.78**	-0.03
32	0.26	0.29	**0.42**	0.00
33	0.20	**0.75**	0.01	-0.08
34	0.16	**0.79**	-0.03	-0.04
35	0.06	**0.77**	0.05	0.07
36	0.10	**0.78**	-0.05	0.11
37	0.06	**0.87**	-0.03	0.04
38	-0.17	**0.73**	0.23	0.14
39	-0.07	**0.79**	0.13	0.10
40	**0.61**	0.24	0.13	-0.04

B. Critical Thinking

The critical thinking rubric is clearly the most problematic. Only one underlying critical component is measured. The matrix cannot be rotated with only one factor. Using two factors allows us to map each criterion to a factor and is shown below for informational purposes. The proportion explained by just one factor is 88%. This rubric needs major revisions based on the data. In essence, the current rubric could be reduced to one simple question: does the student think critically. The additional criteria add no significant information.

Table 3: First 10 Eigenvalues, Critical Thinking

	Eigenvalue	Difference	Proportion	Cumulative
1	20.13	19.40	0.88	0.88
2	0.74	0.29	0.03	0.91
3	0.45	0.14	0.02	0.93
4	0.30	0.05	0.01	0.94
5	0.26	0.10	0.01	0.95
6	0.16	0.01	0.01	0.96
7	0.15	0.03	0.01	0.96
8	0.12	0.02	0.01	0.97
9	0.10	0.01	0.00	0.97
10	0.09	0.01	0.00	0.98

Table 4: Critical Thinking Rotated Factor Pattern

Criterion	Factor1	Factor2
1	**0.59**	0.40
2	**0.62**	0.37
3	**0.63**	0.37
4	**0.58**	0.42
5	**0.60**	0.35
6	**0.73**	0.21
7	**0.75**	0.23
8	**0.70**	0.26
9	**0.59**	0.36
10	0.21	**0.78**
11	0.15	**0.83**
12	0.14	**0.87**
13	0.21	**0.80**
14	**0.53**	0.49
15	**0.85**	0.09
16	**0.86**	0.16
17	**0.86**	0.16
18	**0.81**	0.20
19	**0.79**	0.15
20	**0.76**	0.26
21	**0.68**	0.35
22	0.19	**0.81**
23	0.50	0.52

C. Ethics

Table 5 First 10 Eigenvalues, Ethics

	Eigenvalue	Difference	Proportion	Cumulative
1	6.67	5.25	0.48	0.48
2	1.42	0.47	0.10	0.58
3	0.95	0.10	0.07	0.65
4	0.85	0.05	0.06	0.71
5	0.80	0.18	0.06	0.76
6	0.62	0.05	0.04	0.81
7	0.57	0.07	0.04	0.85
8	0.50	0.08	0.04	0.89
9	0.42	0.08	0.03	0.92
10	0.33	0.03	0.02	0.94

Two factors are retained.

Table 6: Ethics Rotated Factor Pattern

Criterion	Factor1	Factor2
1	**0.48**	0.44
2	0.31	**0.49**
3	**0.60**	0.17
4	-0.11	**0.74**
5	0.05	**0.67**
6	**0.46**	0.35
7	**0.58**	0.17
8	**0.88**	-0.14
9	**0.81**	-0.06
10	**0.57**	0.11
11	**0.40**	0.25
12	**0.76**	-0.05
13	0.03	**0.49**
14	0.02	**0.76**

D. Teamwork

Table 7: First 10 Eigenvalues, Teamwork

	Eigenvalue	Difference	Proportion	Cumulative
1	11.12	9.31	0.41	0.41
2	1.81	0.34	0.07	0.48
3	1.47	0.36	0.05	0.53
4	1.11	0.10	0.04	0.57
5	1.01	0.08	0.04	0.61
6	0.93	0.01	0.03	0.65
7	0.92	0.10	0.03	0.68
8	0.82	0.08	0.03	0.71
9	0.74	0.06	0.03	0.74
10	0.68	0.06	0.03	0.76

Although Kaiser's criteria suggests Five factors, commonality greater than 100% is reached which means the model is over identified. Thus, only four factors can be retained using maximum liklihood with the promax oblique transformation. However, using the orthomax varimax pre-rotation does allow us to see the loadings for five factors. Although this will not be consistent with the other tables, it is presented in Table 9 for reference.

Table 8: Teamwork Rotated Factor Pattern, Four Factors

Criterion	Factor1	Factor2	Factor3	Factor4
1	0.11	**0.57**	0.03	0.05
2	0.08	**0.56**	0.03	0.11
3	0.33	**0.48**	-0.05	0.03
4	-0.01	**0.56**	0.19	0.02
5	0.03	0.15	**0.51**	0.00
6	-0.12	**0.57**	0.31	-0.06
7	-0.03	**0.43**	0.37	-0.07
8	**0.50**	0.06	0.12	0.00
9	**0.59**	0.05	0.09	0.05
10	**0.54**	-0.01	0.18	0.13
11	0.12	0.12	0.61	-0.09
12	0.14	0.07	0.59	0.00
13	-0.15	0.35	**0.50**	0.08
14	0.19	0.23	0.21	0.17
15	0.09	0.38	0.26	0.09
16	-0.01	0.20	**0.50**	-0.03
17	0.19	**0.44**	0.18	0.04
18	**0.76**	0.15	-0.17	-0.01
19	**0.58**	-0.21	0.25	0.10
20	**0.51**	0.33	0.03	0.04
21	**0.62**	-0.09	0.30	-0.08
22	**0.71**	0.27	-0.16	-0.05
23	0.33	**0.37**	0.00	0.26
24	0.11	-0.22	**0.47**	0.43
25	-0.01	0.11	-0.08	**0.88**
26	0.06	0.09	0.00	**0.75**
27	0.20	0.14	0.03	**0.51**

Table 9: Teamwork Rotated Factor Pattern, Five Factors

Criterion	Factor1	Factor2	Factor3	Factor4	Factor 5
1	0.12	0.09	**0.42**	-0.08	0.23
2	0.17	0.15	**0.39**	-0.09	0.19
3	0.11	-0.02	0.33	-0.08	**0.46**
4	0.08	0.13	**0.46**	0.04	0.09
5	0.01	0.10	0.25	**0.44**	-0.03
6	0.00	-0.01	**0.65**	0.15	-0.02
7	-0.03	-0.01	**0.54**	0.26	0.01
8	0.04	-0.04	0.04	0.19	**0.48**
9	0.08	0.11	-0.09	0.15	**0.55**
10	0.15	0.11	-0.13	0.25	**0.47**
11	-0.08	0.11	0.24	**0.53**	0.03
12	0.02	0.00	0.23	**0.56**	0.06
13	0.12	0.09	**0.41**	0.36	-0.14
14	0.19	0.18	0.12	0.17	0.17
15	-0.01	**1.05**	-0.07	0.02	-0.05
16	-0.03	0.13	0.27	**0.40**	-0.04
17	0.03	**0.54**	0.14	0.01	0.20
18	0.04	0.01	-0.04	-0.07	**0.79**
19	0.11	0.03	-0.20	0.37	**0.45**
20	0.10	0.07	0.17	0.04	**0.56**
21	-0.05	-0.08	-0.01	0.41	**0.53**
22	0.01	0.02	0.05	-0.08	**0.78**
23	0.32	0.08	0.20	-0.02	**0.39**
24	**0.43**	0.02	-0.08	0.52	-0.06
25	**0.93**	0.00	-0.01	-0.05	-0.02
26	**0.79**	0.06	-0.02	0.02	0.02
27	**0.58**	-0.08	0.09	0.08	0.20

Appendix - ETSU Rubrics

Oral: 50 Criteria

	CONTENT/RESEARCH
	Breadth/Scope
1	Student use multiple and varied sources.
2	Student uses diverse sources (open to diverse input – willing to evaluate data that doesn't fit model).
	Quality
3	Student uses legitimate sources within field.
4	Student uses relevant sources.
	Documentation
5	Sources cited appropriately.
6	Sources cited correctly with respect to accepted format in field.
	ANALYSIS
7	Analyzes quality/relevance of data/source.
8	Is able to identify key information/data from sources to include in presentation.
9	Builds an adequate argument (evidence of inductive thinking).
10	Student identifies audience/groups.
11	Student appropriately targets audience (level of audience and needs/interests of audience).
	ORGANIZATION
	Introduction
12	Introduces self to audience.
13	Introduces topic/purpose of presentation.
14	Provides overview/outline of presentation.
	Body/Content
15	Relevant – inclusion of key information/data.
16	Correct – adequate presentation of current and correct information/data.
	Synthesis
17	Makes connections between ideas/facts/data to construct an effective argument.
18	Develops theme.
19	Demonstrates appropriate/logical sequence of ideas/facts/data.
20	Clarity of ideas/argument.
21	Derives logical conclusions based on information/data gathered (evidence of deductive thinking).
	Conclusion
22	Summarizes key points/facts/data.
	Timing/Pace
23	Allocates time appropriately across topics.
24	Stays within time-limit.
	Visual Aids
25	Free from errors.
26	Have effective layout and composition (appropriate size and font size).
27	Demonstrate key points/support presentation.
28	Are free from unnecessary/distracting information.
	PRESENTATION
	Voice
29	Vocal variation.
30	Appropriate volume.
31	Diction/articulation/enunciation.
32	Appropriate speed of speech.
	Eye Contact
33	Makes eye contact with audience.
	Dress
34	Professional dress (from head to toe).
	Language
35	Grammatically correct.
36	Inclusive (gender-neutral).
37	Free from colloquialisms/slang.
38	Free from verbal fillers (e.g., uh,um).
	Body Language
39	Free from distracting gestures.
40	Free from distracting movement.
41	Professional posture.
42	Relaxed and open.
	Use of Materials
43	Does not read directly from notes or slides.
44	Uses appropriate visual aid for topic/demonstration.
45	Directs audience's attention to key points on visual aids
46	Creativity demonstrated in use of media, overall approach.
	Response to Audience
47	Is able to correctly answer appropriate audience questions.
48	Adjusts presentation based on audience response.
49	Is receptive to audience input.
	OVERALL ASSESSMENT
50	Overall, the student's oral presentation:

Written: 41 Criteria

	CONTENT/RESEARCH
	Breadth/Scope
1	Student use multiple and varied sources.
2	Student uses diverse sources (open to data that doesn't fit model).
	Quality
3	Student uses legitimate sources within field.
4	Student uses relevant sources.
	Documentation
5	Sources cited appropriately.
6	Sources cited correctly with respect to accepted format in field.
	ANALYSIS
7	Analyzes quality/relevance of data/source.
8	Is able to identify key information/data from sources to include in document.
9	Builds an adequate argument (evidence of inductive thinking).
10	Student identifies audience/groups.
11	Student appropriately targets level and needs of audience.
	ORGANIZATION
	Introduction
12	Introduces structure of document to reader via appropriate mechanism (e.g., abstract, table of contents, outline).
13	Introduces topic of document.
14	Addresses/explains significance of topic.
15	Introduces content/structure of document.
	Body/Content
16	Relevance – inclusion of key information/data.
17	Correctness – adequate presentation of current and correct information/data.
18	Appropriate use of graphical information/data (e.g., charts).
19	Succinct presentation of information.
	Synthesis
20	Makes connections between ideas/facts/data to construct an effective argument.
21	Develops theme.
22	Demonstrates appropriate/logical sequence of ideas/facts/data.
23	Clarity of ideas/argument.
24	Derives logical conclusions based on information/data gathered (evidence of deductive thinking).
	Conclusion
25	Summarizes key points/facts/data.
	PRESENTATION
	Format
26	Effectively uses visuals where appropriate (e.g., tables, charts).
27	Has effective structure (e.g., headings, headers and footers, page numbers).
28	Uses appropriate fonts and font sizes.
29	Has uniform spacing.
30	Has expected components (e.g., title page, bibliography).
31	Has effective layout.
32	Complies with assignment requirements.
	Language
33	Is free from grammatical errors.
34	Is free from punctuation errors.
35	Is free from colloquialisms/slang.
36	Displays appropriate word choice.
37	Has appropriate sentence structure.
38	Is inclusive (gender-neutral).
39	Appropriate use of nomenclature.
	Objective
40	Document achieves its objective (e.g., exposition, description, persuasion, narrative, analysis, synthesis).
	OVERALL ASSESSMENT
41	Overall, the student's written document

Teamwork: 28 Criteria

	PROJECT PLANNING
	Group Formation
1	Team becomes acquainted with member's knowledge/expertise.
2	Team identifies and utilizes each member's skill set.
	Goal Setting
3	Team agrees upon problem/project focus and establishes goals.
4	Team breaks problem/project into tasks with milestones/deadlines.
5	Team creates contingency plan(s).
	TEAM MANAGEMENT
	Accountability
6	Team defines quality standards to judge members' contribution.
7	Team members hold each other accountable for progress toward project goal.
8	Each team member offers and accepts constructive criticism and feedback.
	Conflict Management
9	Team is able to negotiate and compromise.
10	Team is able to resolve conflicts without destroying group process.
	TEAM MECHANICS
11	Team has a clear statement of expectations for each member.
12	Team defines mechanisms to coordinate/communicate with members.
13	Team has mechanisms in place to track progress at checkpoints and milestones (meeting minutes/agendas/action plans).
14	Team is flexible/adaptable to changing requirements.
15	Each team member makes a significant contribution.
16	Team holds regular team meetings.
17	Each team member does a fair share of the work.
	TEAM INTERACTION
18	Each member actively listens to other members' ideas.
19	Each member is given equal discussion time.
20	Team members seek information from one another (collaboration).
21	Discussions and questions are encouraged and alternate viewpoints are entertained.
22	Team members show courtesy and respect for other members.
23	Team operates in the fashion required by the assignment (i.e., either synergistically or in a well-coordinated division of labor).
	QUALITY OF RESULTS
	Output
24	Team's output/result is integrated and cohesive (e.g., no redundant material across team members' sections/output).
25	Team accomplished goals established by the instructor.
26	Team completed its work on time.
27	Team's output/result is high quality and professional.
	OVERALL ASSESSMENT
28	Overall, the student:

Critical Thinking: 24 Criteria

	PROBLEM IDENTIFICATION AND DEFINITION
1	Student is able to completely and accurately define the problem.
2	Student demonstrates full understanding of the problem.
3	Student uses classic and/or current tools and references.
4	Student is able to ascertain if additional information/data not stated in the problem is necessary for its resolution.
5	Student is able to identify and disregard extraneous information provided in the problem definition if not relevant to the problem's solution .
	PROBLEM ANALYSIS AND DECOMPOSITION
6	Student breaks down problem into facets/component parts.
7	Student identifies logical connections between facets/component parts.
8	Student uses logic appropriately.
9	Student demonstrates creative thinking where appropriate.
10	Student actively seeks alternative points of view and gives each appropriate consideration.
11	Student considers alternative solutions.
12	Student weighs/evaluates pros and cons of alternative solutions.
13	Student explores implications and consequences of possible solutions.
	PROBLEM SOLVING AND SOLUTION GENERATION
14	Student is able to obtain appropriate supporting information.
15	Solution clearly states assumptions.
16	Solution is testable.
17	Solution can be replicated.
18	Solution is correct/viable/optimal.
19	Solution is original/creative.
20	Solution is well-documented and explained.
21	Solution is planned, not random/accidental.
22	Broader impact of solution (i.e., on the "bigger picture") is considered.
23	Student is able to demonstrate the appropriateness/correctness of the solution.
	OVERALL ASSESSMENT
24	Overall, the student's critical thinking skills:

Ethics: 15 Criteria

	PROFESSIONAL CODE(S) OF ETHICS
1	Student can articulate the primary tenets of the profession's code of ethical conduct.
2	Student is familiar with code(s) of ethics and standard(s) of professional practice within the discipline.
3	Student can state the application of the code of ethics in the practice of the profession.
4	Student is familiar with the ETSU Honor Code.
	ANALYSIS
5	Student is able to recognize an ethical dilemma or issue within his profession.
6	Student can identify stakeholders in an ethical dilemma/issue and can demonstrate awareness of differing perspectives of those stakeholders.
7	Student is able to recognize and analyze ethical dimensions/complexities of a dilemma.
8	Student is able to identify alternative courses of action/solutions regarding an ethical dilemma.
9	Student is able to evaluate both immediate and long-term risks/consequences of alternative courses of action.
10	Student is able to identify the law(s) relevant to an ethical dilemma and understands what is necessary to comply with the law(s).
11	Student can formulate practices or policies to try to prevent recurrence of dilemma or issue.
12	Student can demonstrate understanding of the need for checks and balances in the organization (e.g., internal controls, disclosure requirements).
	COMMUNICATION
13	Student is able to identify organizational mechanisms for reporting unethical activities/behavior.
14	Student can state his/her rights and options in regard to reporting unethical activities/behaviors.
	OVERALL ASSESSMENT
15	Overall, the student's ethical understanding: