

# Outline of a Framework and Roadmap for Collaborative Problem Solving Assessment

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# Talk Summary

- Employers want workers with collaborative skills
- Consequently schools are starting to teach collaboration
- But we don't know how to measure collaboration very well, other than with ratings, so we can't tell how we're doing
- There are a number of challenges in collaborative assessment, such as how to assign credit, what the best process measures are, how student background variables and task variables affect team performance, and how best to measure individual and collective outcomes
- There is an immediate demand for good collaborative assessments, to monitor student growth, for development uses, and for admissions (especially higher education) and employment selection

# Employers want workers with collaborative skills

- Department of Labor’s O\*NET (Occupational Network)
  - “Teamwork” factor rated 3<sup>rd</sup> “most important factor (of 15; behind “Problem Solving” and “Reasoning Ability” ahead of “Achievement/Innovation” and “Science and ITC literacy” (Burrus et al, 2013)
- Other employer surveys (NACE, Conference Board et al., Millenium)
- Performance evaluation (e.g., Lomingers 67 competencies)

\*Burrus et al. (2013). *Identifying the Most Important 21st Century Workforce Competencies: An Analysis of the Occupational Information Network (O\*NET)*. ETS Research Report. Princeton, NJ: ETS.

## The Candidate Skills That Employers Want

National Association of Colleges and Employers (NACE) *Job Outlook 2014* Survey (Data N = 208 college recruiting professionals, across U.S., manufacturing, service, retail, transportation, government)

| Skill/Quality  | Average Rating (1 – 5)<br>(1: Not at all; 3: somewhat; 5: Extremely important) |
|--|--|
| Ability to work in a team structure  | 4.6  |
| Ability to make decisions and solve problems                                     | 4.5  |
| Ability to plan, organize, and prioritize work                                   | 4.5  |
| Ability to verbally communicate with persons inside and outside the organization | 4.5  |
| Ability to obtain and process information  | 4.4  |
| Ability to analyze quantitative data   | 4.3  |
| Technical knowledge related to the job   | 4.0  |
| Proficiency with computer software programs                                      | 3.9  |
| Ability to create or edit written reports  | 3.6  |
| Ability to sell or influence others  | 3.5  |

# Millennial Branding Student Employment Gap Study

(225 Employers from Experience Inc.'s 100,000 company database)

|                                | What skills are you looking for when you hire? | What skills are hardest to find, but most important to you? |
|--------------------------------|--|---|
| <b>Communication Skills</b>    | <b>98%</b>                                     | <b>91%</b>  |
| Positive Attitude              | 97%  | 85%   |
| Adaptable to Change            | 92%  | 85%   |
| <b>Teamwork Skills</b>         | <b>92%</b>                                     | <b>82%</b>  |
| Goal Oriented                  | 88%  |   |
| Strategic Thinking & Analytics |  | 78%   |

*"Companies are looking for soft skills over hard skills now because hard skills can be learned, while soft skills need to be developed."*

<http://millennialbranding.com/2012/05/millennial-branding-student-employment-gap-study/>

## Employers Rating Skill as “Very Important”

|                                   | College graduates | High School Graduates |
|-----------------------------------|-------------------|-----------------------|
| <b>Oral Communications</b>        | <b>95%</b>        | <b>70%</b>            |
| <b>Teamwork/Collaboration</b>     | <b>94</b>         | <b>75</b>             |
| Professionalism/Work Ethic        | 94                | 80                    |
| <b>Written Communications</b>     | <b>93</b>         | <b>53</b>             |
| Critical Thinking/Problem Solving | 92                | 58                    |
| <b>English Language</b>           | <b>88</b>         | <b>62</b>             |
| Ethics/Social Responsibility      | 86                | 63                    |
| Leadership                        | 82                | 29                    |
| Information Technology            | 81                | 53                    |
| Creativity/Innovation             | 81                | 36                    |
| Lifelong Learning/Self direction  | 78                | 43                    |
| Diversity                         | 72                | 52                    |
| Mathematics                       | 64                | 30                    |
| Science                           | 33                | 9                     |

# Lominger's 67 Competencies

|                             |                             |                           |                        |                          |                             |
|-----------------------------|-----------------------------|---------------------------|------------------------|--------------------------|-----------------------------|
| Action Oriented             | Confronting Direct Reports  | Hiring and Staffing       | Motivating Others      | Political Savvy          | Building Effective Teams    |
| Dealing with Ambiguity      | Creativity                  | Humor                     | Negotiating            | Presentation Skills      | Technical Learning          |
| Approachability             | Customer Focus              | Informing                 | Organizational Agility | Priority Setting         | Time Management             |
| Boss Relationships          | Timely Decision Making      | Innovation Management     | Organizing             | Problem Solving          | Total Work Systems          |
| Business Acumen             | Decision Quality            | Integrity and Trust       | Dealing With Paradox   | Process Management       | Understanding Others        |
| Career Ambition             | Delegation                  | Intellectual Horsepower   | Patience               | Drive for Results        | Managing Vision and Purpose |
| Caring About Direct Reports | Developing Others           | Interpersonal Savvy       | Peer Relationships     | Self-Development         | Work/Life Balance           |
| Comfort Around Management   | Directing Others            | Learning on the Fly       | Perseverance           | Self-Knowledge           | Written Communication       |
| Command Skills              | Managing Diversity          | Listening                 | Personal Disclosure    | Sizing Up People         |                             |
| Compassion                  | Ethics and Values           | Managerial Courage        | Personal Learning      | Standing Alone           |                             |
| Composure                   | Fairness to Direct Reports  | Managing & measuring work | Perspective            | Strategic Agility        |                             |
| Conflict Management         | Functional/Technical Skills |                           | Planning               | Managing Through Systems |                             |

Because of concerns for work readiness

# **SCHOOLS ARE BEGINNING TO FOCUS ATTENTION ON TEACHING COLLABORATION**



- Common Core State Standards
  - NRC report (Pellegrino & Hilton, 2013)
- OECD--PISA 2015
- US Department of Education (National Center for Education Statistics)
  - NAEP Innovations Symposium: “Collaborative Problem Solving (CPS)” “necessary to succeed in today's society.”
- Promoted by educational non-profits
  - (e.g., ACT21S; Partnership for 21<sup>st</sup> century skills [P21])
    - 4 C’s--“Creativity, Communication, Critical Thinking, and Collaboration”
- Brazil (and other countries) monitoring the growth of noncognitive skills from 1<sup>st</sup> grade through 12<sup>th</sup> grade
  - Economics of skill development— schools teach more than math & reading
- Higher Education – Graduate School, Business School

# "21<sup>st</sup> Century Skills"

## Interpersonal skills

- Communication Skills
- Teamwork (Collaboration, Social skills)
- Leadership
- Social-Cultural sensitivity (responsibility, awareness, tolerance for diversity)
- Emotional/ social intelligence

## Cognitive

- Problem solving & critical thinking
- Information Technology Literacy
- Creativity/Innovation
- Global/Cultural Skills
- Quantitative & Scientific Inquiry Skills

## Intrapersonal

- Self-regulation (time management, work ethic, persistence, organization, adaptability)
- Self-management (life & career; physical, psychological health)
- Self-development (life-long learning)
- Emotional regulation (anxiety, self-efficacy, self-concept, attributions, subjective well being)
- Ethics & Integrity (personal responsibility)
- Attitudes (interests, aspirations)

# HOW DO WE CURRENTLY MEASURE COLLABORATIVE SKILL IN THE SCHOOLS?

# Single Statements Rating Scale

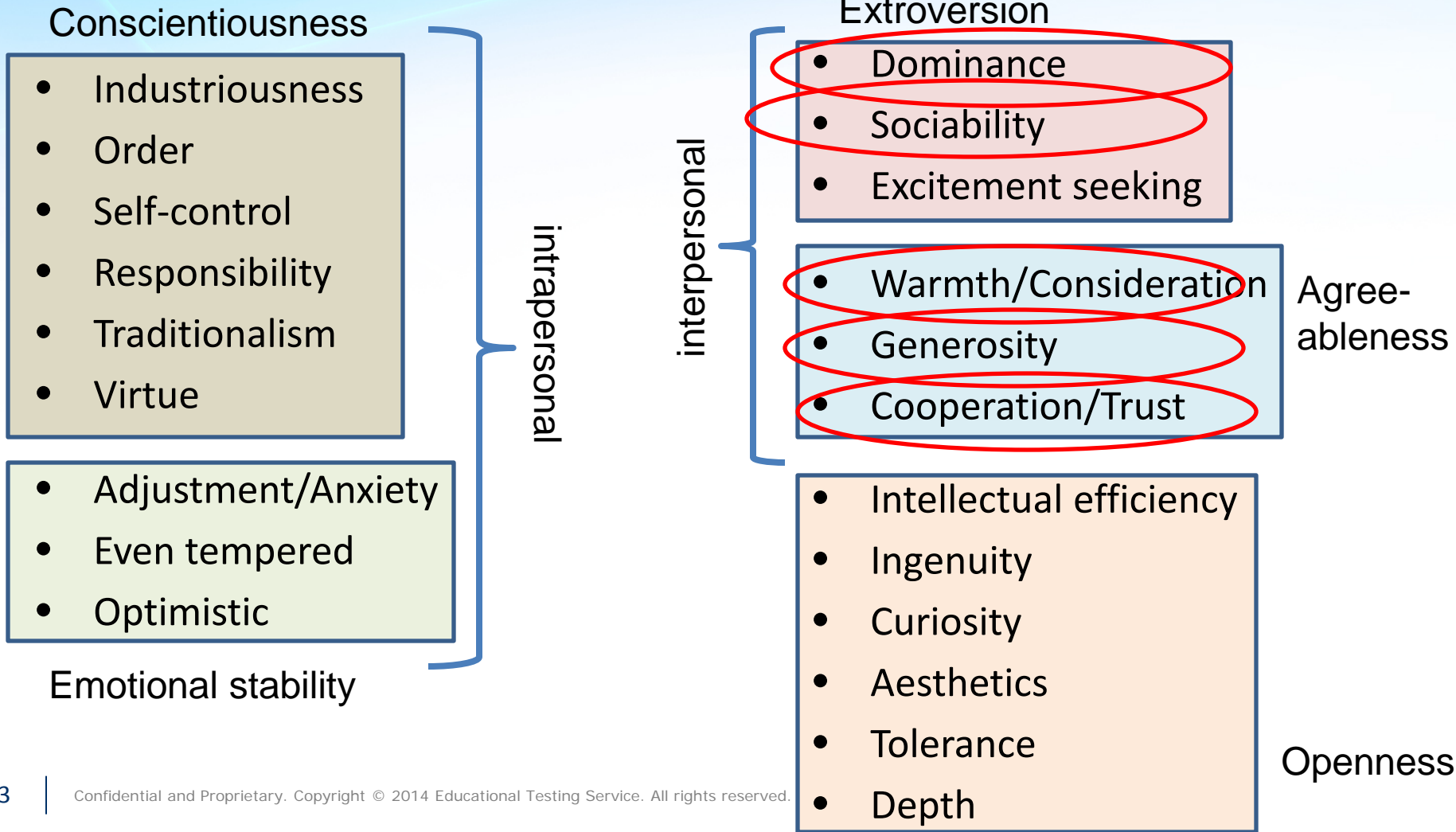
Please indicate your answer to each item by clicking on the appropriate circle

|    |                         | Strongly disagree     | Disagree              | Agree                 | Strongly agree        |
|----|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. | I keep my promises      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. | I work well with others | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

This is by far the most widely used approach.

We can improve on these with  
**teacher ratings,**  
**anchoring vignettes,**  
**forced-choice & ranking methods**  
**situational judgment tests**

# Big 5 and Facets



# Situational Judgment Tests (SJTs)

## “Teamwork & Collaboration”

As part of a class project you serve as a volunteer for a non-profit agency. In a discussion about how to find new volunteers, you bring up what you think is a great new idea. But the others tell you that the idea is “off base” and not workable. How would you handle this situation?

Best   Worst

- |                       |                       |   |
|-----------------------|-----------------------|---|
| <input type="radio"/> | <input type="radio"/> | Drop your idea because the group is probably right.                       |
| <input type="radio"/> | <input type="radio"/> | Point out several good reasons why your idea might work.                  |
| <input type="radio"/> | <input type="radio"/> | Drop your idea for now, but tell it to your boss later.                   |
| <input type="radio"/> | <input type="radio"/> | Tell the others that lots of people don't recognize great ideas at first. |

These are fine as far as they go, but there is an expressed need to have performance-based measures (not just ratings, rankings) of collaborative problem solving (such as PISA 2015, and the ATC21S measure).

We need a broader framework for assessing collaborative skill embedded in the school curriculum.

**single statements,**  
**teacher ratings,**  
**anchoring vignettes,**  
**forced-choice & ranking methods**  
**situational judgment tests**

CPS Framework

# **TOWARDS A TAXONOMY OF COLLABORATIVE PROBLEM SOLVING**



# Some Preliminary Issues in Collaborative Assessment in Schools

- When is collaboration useful?
  - When are we better off working alone?
  - Does collaboration improve individual performance?
  - If it does, how?
    - Do students learn new & better strategies?
    - Does working together increase motivation?
- Why does collaboration sometimes fail?
  - Coordination is difficult
    - Interpersonal conflicts, hurt feelings, social loafing
    - Disagreements about goals, off-topic conversation, time wasting
- How do we assign individual credit?

# Towards a Taxonomy of CPS

- Type of Interaction (cooperative, competitive, independent)
- Task content (Curricular (Math, Reading, Science), Cross-curricular (Problem Solving, Critical Thinking), Social/Interpersonal, Intrapersonal, Physical (Athletics))
- Task Nature (well/ill defined)
- Group composition (ability, gender/status, roles)
- Evaluations (individual, team, process)
- Measures (of process outcomes)
  - # statements, turn taking, participation
  - Personal acknowledgement
  - Goal & planning statements
  - Comprehension monitoring: elaborations, diagrams, explanations, summarizations, Q&A
  - Recognizing & resolving contradictions
  - Understanding/learning effective problem solving strategies

# Collaborative Assessment

## Participant background

- Cognitive ability
- Personality
- Content knowledge
- Social skills
- Gender, demographics
- Experience
- Heterogeneity

## Task variables

- Well vs. ill defined
- Assigned roles
- Content
- Cooperative vs. competitive

## Process Variables

- # Statements, turn taking, participation
- Personal acknowledgement
- Goal & planning statements
- Comprehension monitoring elaborations, diagrams, explanations, summarizations, Q&A
- Recognizing & resolving contradictions
- Understanding/learning effective problem solving strategies.

## Outcomes

### Individual student learning outcomes

Content  
Strategies  
Learning about collaboration

### Team outcomes

Task knowledge  
Team knowledge  
Situational awareness

# Some Questions We Would Like to See Addressed

- What is the quantifiable benefit of collaboration?
  - as a function of type of interaction, nature of the task, group composition,
  - on individual vs. team vs. process outcomes, using various process measures
- Are there good teams (“collective intelligence”)?
  - How task specific is that?
- What are the characteristics of good teams?
- Are there good team members?
  - Task specific?
- What are the characteristics of good team members?
  - How important are personal attributes vs. prior relationships?

# Summary

- There is a strong, immediate demand for assessments that can identify individuals and measure teams on collaborative skill
  - K-12
  - Higher Education
  - Workforce
- These assessments will be used for selection (and admissions), development (student, employee, team), and growth monitoring (at school, district, jurisdiction levels)