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Assessing Key Interpersonal Competencies: Why Understanding Collaboration Processes Can Support Learning Academic Content

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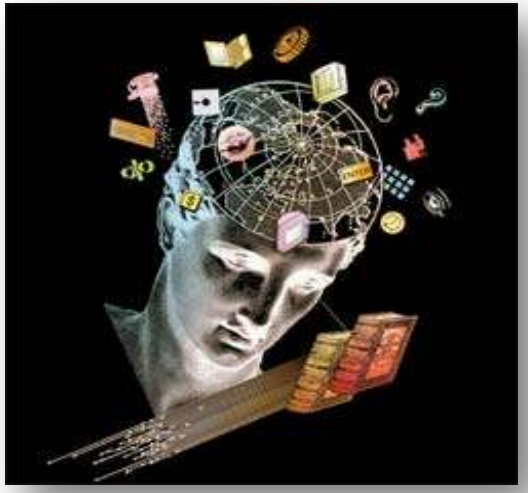
Overview

- 1. Why do Interpersonal Competencies Matter
- 2. Understand Teamwork and Teamwork Competencies
- 3. Acquiring Interpersonal Competencies (and course content) via Active Learning
- 4. Traditional Methods for IPS Assessment
- 5. The Next Frontier in IPS Assessment?



Part 1. Why Competencies Matter

AAC&U Survey on Colleges and Careers

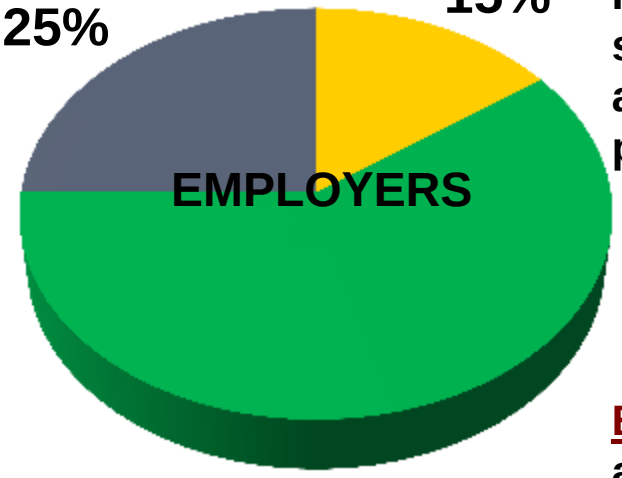
- 400 executives at private-sector and nonprofit organizations that have 25 or more employees
  - *25% or more of new hires hold either AA or BA/BS degrees*
- 613 college students
  - *Within a year of obtaining degree or transferring to a four-year college*
  - *304 students at four-year public colleges, 151 students at four-year private colleges, and 158 students at two-year colleges*

Hart Research Associates. (2015). *Falling Short? College Learning and Career Success*. Washington, DC: Association of American Colleges and Universities.

Part 1. Why Competencies Matter

- **QUESTION: Which is more important for recent college graduates to have who want to pursue advancement and success at your company?**
  - ***Three in five employers believe that it takes BOTH specific knowledge/skills and broad knowledge/skills to achieve long-term career success.***

Range of knowledge and skills that apply to a range of fields or positions



Knowledge and skills that apply to a specific field or position

Both field-specific and broad range of knowledge and skills

COLLEGE STUDENTS:	
• Range	22%
• Specific	15%
• Both	63%

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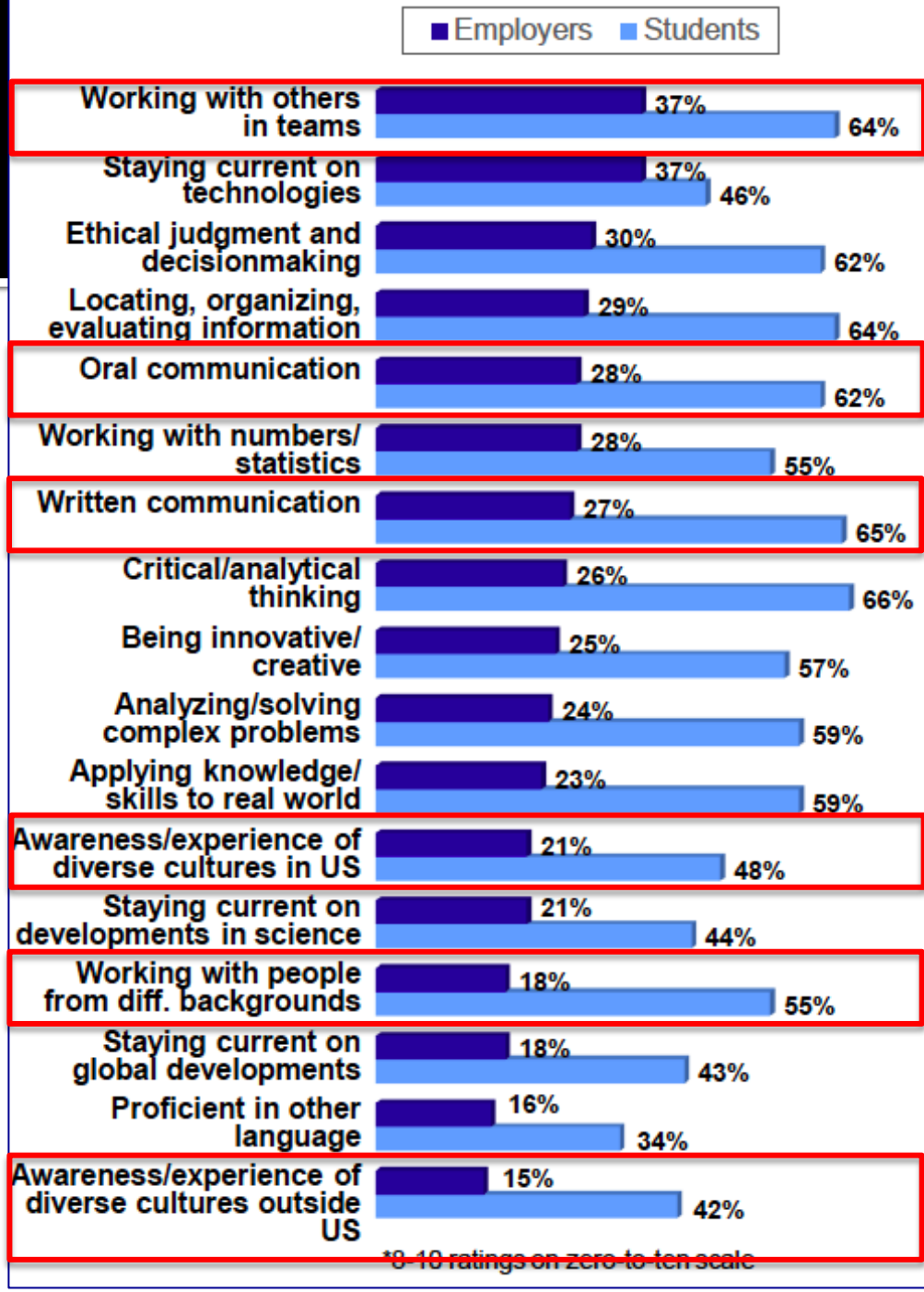
Employers and College Students Rate the Importance of College Learning Outcomes

(Proportion of employers and students who rate each outcome an 8, 9, or 10 on a zero-to-10 scale)

	Employers %	College Students %
The ability to effectively communicate orally	85	78
The ability to work effectively with others in teams	83	77
The ability to effectively communicate in writing	82	75
Ethical judgment and decision-making	81	74
Critical thinking and analytical reasoning skills	81	79
The ability to apply knowledge and skills to real-world settings	80	79
The ability to analyze and solve complex problems	70	73
The ability to locate, organize, and evaluate information from multiple sources	68	73
The ability to innovate and be creative	65	69
Staying current on changing technologies and their applications to the workplace	60	68
The ability to work with numbers and understand statistics	56	55
The ability to analyze and solve problems with people from different backgrounds and cultures	56	71
Awareness of and experience with diverse cultures and communities within the United States	37	58
Staying current on developments in science	26	49
Staying current on global developments and trends	25	49
Awareness of and experience with cultures and societies outside of the United States	23	46
Proficiency in a language other than English	23	35

Part 1. Why Competencies Matter

- Proportions saying they/recent college graduates are well prepared in each area
  - Employers give college graduates low scores for preparedness across learning outcomes
  - AND students think they are better prepared.



Part 1. Why Competencies Matter

AAC&U Survey on Colleges and Careers

- Employers and students believe that it takes BOTH specific knowledge/skills and broad knowledge/skills to be successful
- Collaborative and Cognitive/Content Skills rated as very important
- Students think they are better prepared than employers find them to be, particularly for what we'd consider interpersonal skills

  - INTERPRETATION: Students vastly overestimate collaboration skills because:
    - First, they engage in a great deal of group work in school
    - Second, their group work is never evaluated on collaborative processes (only on learning content)

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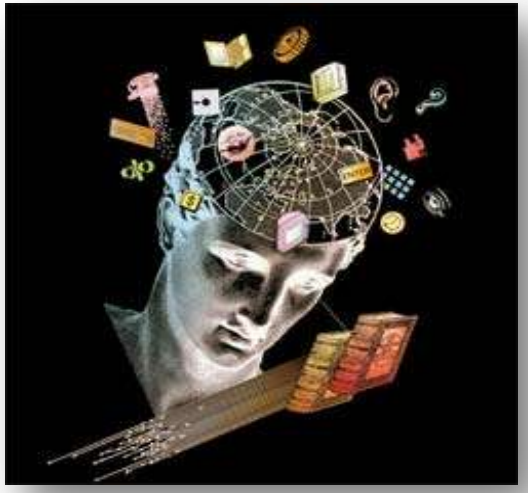

Part 2. Understanding Teamwork and Teamwork Competencies

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- Teamwork inside and outside of STEM/SCIENCE
  - Brings people together to achieve objective(s) that an individual could not achieve and do so while maintaining partially overlapping knowledge
- What do we mean by teams
  - Multiple information sources and intensive communication
  - Task-relevant knowledge with meaningful task interdependencies
  - Affective and attitudinal factors influence group dynamics
  - Coordination among members with specialized roles

Fiore, S. M. (2008). Interdisciplinarity as teamwork: How the science of teams can inform team science. *Small Group Research, 39(3),* 251-277.

Part 2. Understanding Teamwork and Teamwork Competencies

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Effective teams engage in both TASKwork and TEAMwork

- TASKwork refers to what needs to be accomplished to meet goals and complete objectives (Morgan et al., 1986)
- This is the content relevant "work" of teams (Fiore, 2008)
- Can be categorized along dimensions based upon KSAs for TASKwork
  - Knowledge necessary for a project
    - Understanding the relevant theories and constructs
  - Skills supporting execution of a project
    - Developing and running experiments and analyzing and writing findings
  - Attitudes about particulars of a project
    - Preferences for methodological approaches, trust in certain technologies

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Morgan, B. B., Jr., Glickman, A. S., Woodard, E. A., Blaiwes, A. S., & Salas, E. (1986). *Measurement of team behaviors in a Navy environment (NTSC Tech. Rep. No. 86-014)*. Orlando, FL: Naval Training Systems Center.

Part 2. Understanding Teamwork and Teamwork Competencies

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Effective teams engage in both TASKwork and TEAMwork

- TEAMwork refers to the factors required to function effectively as part of an interdependent team (Morgan et al., 1986)
- This the collaborative component of team science (Fiore, 2008)
- Can be categorized along dimensions based upon KSAs for TEAMwork
  - Knowledge associated with teammates
    - Understanding the roles and responsibilities and their capabilities
  - Skills supporting interaction with teammates
    - Communicating effectively about project and managing conflict
  - Attitudes about teammates based upon interactions
    - Trust in teammates and sense of cohesion with teammates

Fiore, S. M. (2008). Interdisciplinarity as Teamwork: How the Science of Teams can inform Team Science. *Small Group Research, 39(3),* 251-277.

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Part 2. Understanding Teamwork and Teamwork Competencies

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Team and Task Competencies

- Way to classify team/task competencies as knowledge, skills, and attitudes necessary in nearly all team situations versus specific to certain teams (Cannon-Bowers et al., 1995).

Team Competencies

- ❑ **TEAM GENERIC** competencies are those necessary regardless of the context or the scientific setting
- ❑ **TEAM SPECIFIC** competencies are more directly related to teams and include knowledge of roles within the team and the abilities held by team members

Task Competencies

- ❑ **TASK GENERIC** competencies are those necessary across task situations
- ❑ **TASK SPECIFC** competencies important within particular task

Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining competencies and establishing team training requirements. In R. A. Guzzo & E. Salas (Eds.), *Team effectiveness and decision making in organizations* (pp. 333-381). San Francisco: Jossey-Bass.

Fiore, S. M. (2008). Interdisciplinarity as Teamwork: How the Science of Teams can inform Team Science. *Small Group Research, 39(3),* 251-277.

Part 2. Understanding Teamwork and Teamwork Competencies

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		Relation to TASK	
		Specific	Generic
Relation to TEAM	Specific	***CONTEXT DRIVEN*** • Knowledge – *Team objectives and resources* • Skills – *Particular analyses* • Attitudes - *Collective efficacy*	***TEAM CONTINGENT*** • Knowledge – *Teammate characteristics* • Skills – *Providing teammate guidance* • Attitudes – *Team cohesion*
	Generic	***TASK CONTINGENT*** • Knowledge – *Procedures for task accomplishment* • Skills – *Problem analysis* • Attitudes – *Trust in technology*	***TRANSPORTABLE*** • Knowledge – *Understanding group dynamics* • Skills – *Communication and assertiveness* • Attitudes – *Interdisciplinary appreciation*

Fiore, S. M. & Bedwell, W. (2011). Team Science Needs Teamwork Training. *Presented at the 2nd Annual Science of Team Science Conference.* April, Chicago, IL.

Part 2. Understanding Teamwork and Teamwork Competencies

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SUMMARY: *Understanding teamwork competencies*

- Teams brought together to achieve objective(s) that individual could not achieve while maintaining partially overlapping knowledge
  - Deal with multiple information sources, intensive communication, and meaningful task interdependencies
- Management of TEAMwork and TASKwork KSAs related to effectiveness of teams
  - Differentiating between GENERIC and SPECIFIC competencies adds level of precision for learning and measurement
- We must understand the complex inter-relations between these factors
- *Now discuss variety of "active learning" approaches used for learning "task content" and "collaboration processes"*

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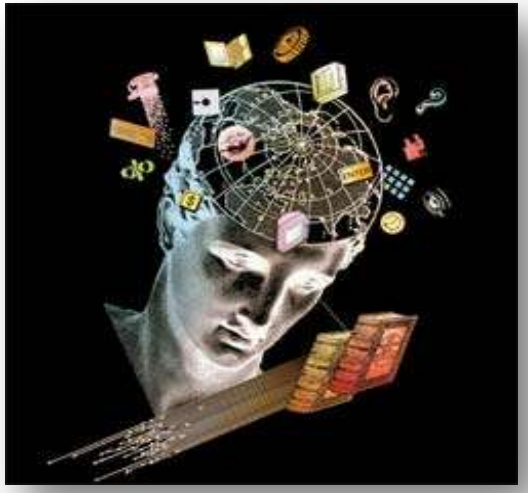

Part 3. Acquiring Interpersonal Competencies (and course content) via Active Learning

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ACTIVE Learning in Higher Education

- Embedding course material in integrated learning environments
  - Comprehension of **content** AND application of **generic skills**
- Construction of meaning occurs through reorganization of existing mental structures with newly acquired knowledge
  - Grasping new material and acquiring new skills require **dynamic cognitive processing** from learners
  - Offer opportunities for students to **apply and integrate knowledge**
- Dual focus
  - Acquisition of **discipline-specific knowledge**
  - Acquisition of **generic higher order skills** that are more globally transferable

Gabelica, C. & Fiore, S. M. (2013). What Can Training Researchers Gain from Examination of Methods for Active-Learning (PBL, TBL, and SBL). *Proceedings of 57th Annual Meeting of the Human Factors and Ergonomics Society* (pp. 462-466). Santa Monica, CA: Human Factors and Ergonomics Society.

Part 3. Acquiring Interpersonal Competencies (and course content) via Active Learning

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PROBLEM-based Learning

- Most widespread active learning approach
  - Student-centered and practically-oriented pedagogy
  - Small group format with authentic and ill-structured problems
  - Tutors serve as learning coaches
    - Facilitating and monitoring the process
    - Helping students identify relevant knowledge
- PBL-cycles are highly structured:
  - Description of a real-life problem (constructed by faculty)
  - Answer two questions:
    1) "What do we know about the subject (problem representation)?"
    2) "What do we have to find out to solve the problem (identification of knowledge deficiencies and learning goals)?"

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Part 3. Acquiring Interpersonal Competencies (and course content) via Active Learning

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PROBLEM-based Learning

- Following tutorial session:
  - Students given independent study time
  - Collect relevant resource material
  - Integrate knowledge from different disciplines

- During next session:
  - Group discusses what they learned
  - Integrate information they found
  - Expected to reflect at a higher level of abstraction on the new knowledge they gained

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Part 3. Acquiring Interpersonal Competencies (and course content) via Active Learning

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TEAM-based Learning

- Growing area of inquiry in medical and health sciences
  - Comprehensive teacher-directed method
  - Small independent leaning teams in larger classes
  - Complex problems or application activities in class
  - Out-of-class preparation
- Structural aspects and sequence:
  - Teams composed of 5-7 students
  - Confronted with real-word scenarios (problem-solving or "application" activities)
  - Prepared by a content-expert instructor

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TEAM-based Learning

- **Students go through three steps**
  1) **Out-of-class preparation time**
  2) **Readiness assurance test to demonstrate preparation**
  3) **Small group problem-solving activity (emphasis on application of learned concepts)**
  4) **Collective discussion in the large class**

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STUDIO-based Learning

- Developed in design-related areas (e.g., architecture/industrial design)
  - Based on idea that learning is situated and emphasizes the importance of practical experience
  - Initial problem is highly ill-structured
  - Involves multiple paths, constraints, and unknown variables discovered throughout the process
- Problem is focus of inquiry that helps students learn to experiment
  - Becomes starting point of an iterative process
  - Students produce and improve design solutions
  - Do so in collaboration with others in an interactive studio space
  - Emphasis on frequent critiques of work-in-progress

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STUDIO-based Learning

- Instructors act as experts and support student work
  - Discussions, explicit prompts, assignments, and reminders.
  - Model and coach the inquiry process
- Formative and formal reviews are regularly organized
  - Instructors (and sometimes peers and professional guests) examine students' design solutions
  - Based on students' material and reasoning
  - Give feedback to refine work accordingly

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Part 3. Acquiring Interpersonal Competencies (and course content) via Active Learning

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Key Features Across PBL/TBL/SBL for Learning Collaborative Competencies

- **Consider the CONTEXT**
  - ✓ Implement use of small groups in classes
  - ✓ Use complex and real-world problems
  - ✓ Ensure multiple interactions among learners and instructors
- ✓ **But it is really about PROCESS**
  - ✓ Provided immediate and regular feedback (from instructors or peers)
  - ✓ Formative assessment allowing for refinements and adjustments
  - ✓ Encourage meta-discussions (via metacognitive techniques)
  - ✓ Utilize explicit training of problem solving skills
  - ✓ Instructor provides scaffolding/modeling of interactions with team and on task
- **Researchers need to isolate core features of active learning approaches AND measure collaborative processes to study connections between learning content and learning collaboration**

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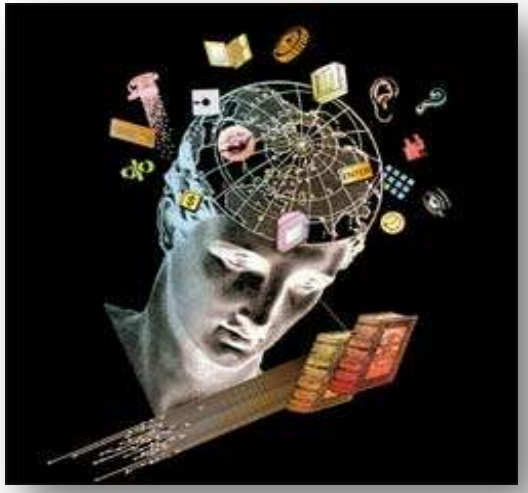


4. Traditional Methods for IPS Assessment

4.1. *Interpersonal Skills as Transportable Team Skills*

- Klein and colleagues (2006) reviewed and synthesized literature on IPS to develop taxonomy of IPS
- Considers - Goal-directed behaviors, including communication and relationship-management competencies

- Employed during interaction episodes characterized by:
  - complex situations
  - dynamic verbal and nonverbal exchanges
  - diverse roles and knowledge

Klein, C., DeRouin, R. E., & Salas, E. (2006). Uncovering workplace interpersonal skills: A review, framework, and research agenda. In G. P. Hodgkinson & J. K. Ford (Eds.), *International review of industrial and organizational psychology* (Vol. 21, pp. 80-126). New York: WIley & Sons, Ltd.

4. Traditional Methods for IPS Assessment

4.1. *Interpersonal Skills as Transportable Team Skills*

Communication Competencies (Fiore et al., 2013, adapted from Klein et al. 2006)	
Active Listening	• Carefully attending to <u>what is said</u> • Asking other party to explain exactly <u>what is meant</u> • Requesting that <u>ambiguous ideas</u> or statements are <u>repeated</u>
	For collaboration this competency targets "listening to learn and understand" and "listening to contribute and integrate to problem solving"
Oral and Written Communication	• Sending verbal and written <u>messages clearly</u> • Speaking/writing <u>constructively</u> • Speaking/writing <u>critically in appropriate ways</u>
	For collaboration this competency targets the ability to "express yourself clearly to others outside one's discipline" (e.g., avoiding jargon) and "effectively conveying intended meaning of other disciplinary perspectives"
Assertive Communication	• Directly <u>expressing</u> one's <u>ideas and opinions</u> • Addressing <u>conflict purposely</u> and openly • <u>Addressing differences</u> without intimidation
	For collaboration this competency targets the ability to "propose ideas", to "defend one's disciplinary values/methods" and to "be directive and appropriately assert your needs and views"

4. Traditional Methods for IPS Assessment

4.1. *Interpersonal Skills as Transportable Team Skills*

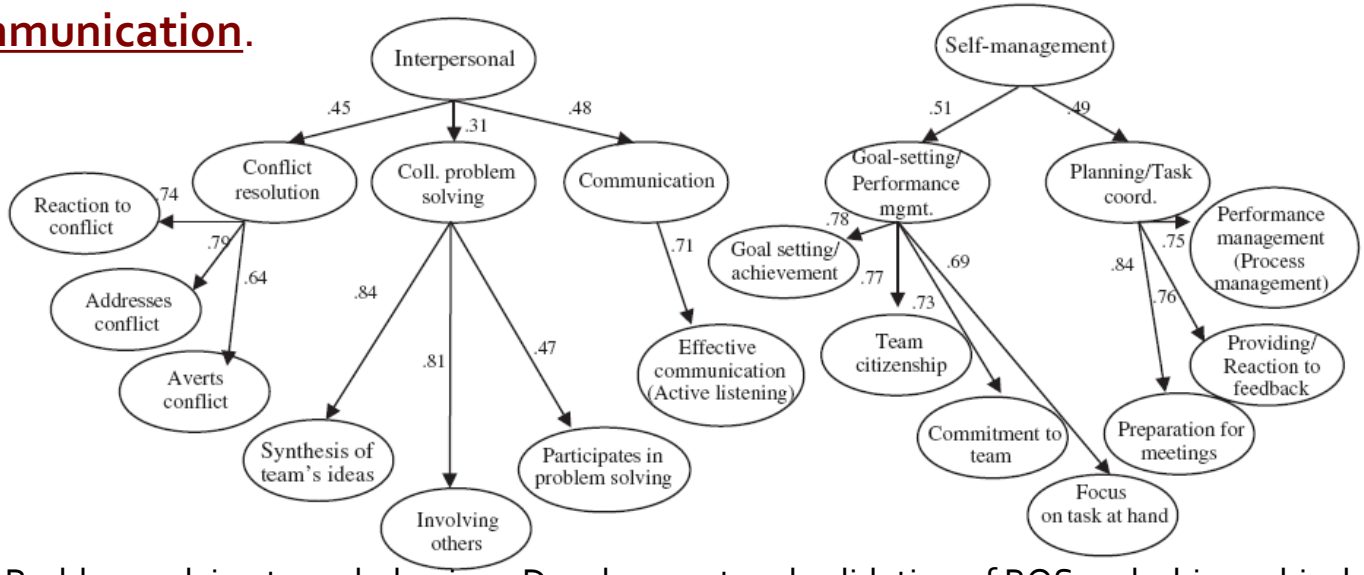
Relationship Management Competencies (Fiore et al., 2013, adapted from Klein et al. 2006)	
Coordination	• Understanding how to work with others as a team • Being mindful of interdependencies and how to pace activities • Offering help/back-up as needed
	For collaboration this competency targets understanding importance of "awareness of shared scientific goals" and "monitoring and feedback"
Interdisciplinary Appreciation	• Appreciating differing disciplinary theories and concepts • Respecting varied disciplinary methods • Encouraging input from across disciplinary perspectives
	For collaboration this competency targets learning "acceptance of, and openness to new ideas" and "sensitivity to disciplinary perspectives"
Collaborative Orientation	• Predisposition to provide help to others • Intellectual curiosity in service understanding others • Building rapport with others
	For collaboration this competency targets the ability to "elicit ideas for purpose of understanding" and "offer solutions in support of problem solving"

4. Traditional Methods for IPS Assessment

4.2. Observational Scales for Team/Task Competencies

Measuring TEAM and TASK Competencies

- **Questionnaires using Observational Scales**
- Focuses on **observable skills** rather than relying on self- (or other) report
  - **Behavioral referents** focus rater's attention to relevant facets of IPS.
  - Taggar & Brown (2001) developed BOS for interpersonal skills and self-management.
  - Derived BOS from critical incidents to provide context relevant examples.
  - Interpersonal skills consisted of **(1) conflict resolution, (2) collaborative problem solving, and (3) communication**.



Taggar, S., & Brown, T. C. (2001). Problem-solving team behaviors: Development and validation of BOS and a hierarchical factor structure. *Small Group Research*, *32*, 698-726.

4. Traditional Methods for IPS Assessment

4.4. *Peer-Ratings for Team/Task Competencies*

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***Measuring* TEAM and TASK Competencies**

- **Questionnaires using PEER-Ratings**
  - Loughry, Ohland, and Moore (2007) developed the Comprehensive Assessment of Team Member Effectiveness (CATME).
  - 87-item measure with 5 general categories of team member contribution:
    - (1) **contributing** to the team's work
    - (2) **interacting** with teammates
    - (3) keeping the **team on track**
    - (4) expecting **quality**
    - (5) having **relevant KSAs**

Ohland, M.W., Loughry, M.L., Woehr, D.J., Finelli, C.J., Bullard, L.G., Felder, R.M., Layton, R.A., Pomeranz, H.R., & Schmucker, D.G. (2012). The Comprehensive Assessment of Team Member Effectiveness: Development of a Behaviorally Anchored Rating Scale for Self and Peer Evaluation. *Academy of Management Learning & Education, 11 (4),* 609-630.

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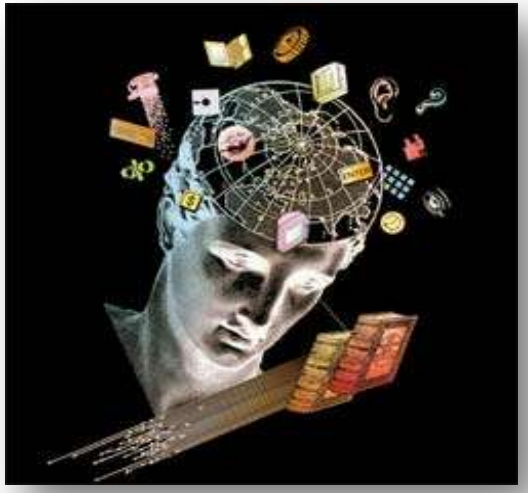


5. The Next Frontier in IPS Assessment?

5.1. Interacting Bodies in Virtual Worlds

Virtual Worlds may support contextually rich assessment of interpersonal skills

- Can immerse students in challenging social scenarios and diagnose degree to which interpersonal skills demonstrated.

- **Recent studies find that personalities are expressed in VWs**
  - VW behavioral cues reflect trait definitions of standard personality factors
  - "Extraverts" prefer group-oriented activities
  - "Agreeable" use more positive emotes and prefer non-combat activities

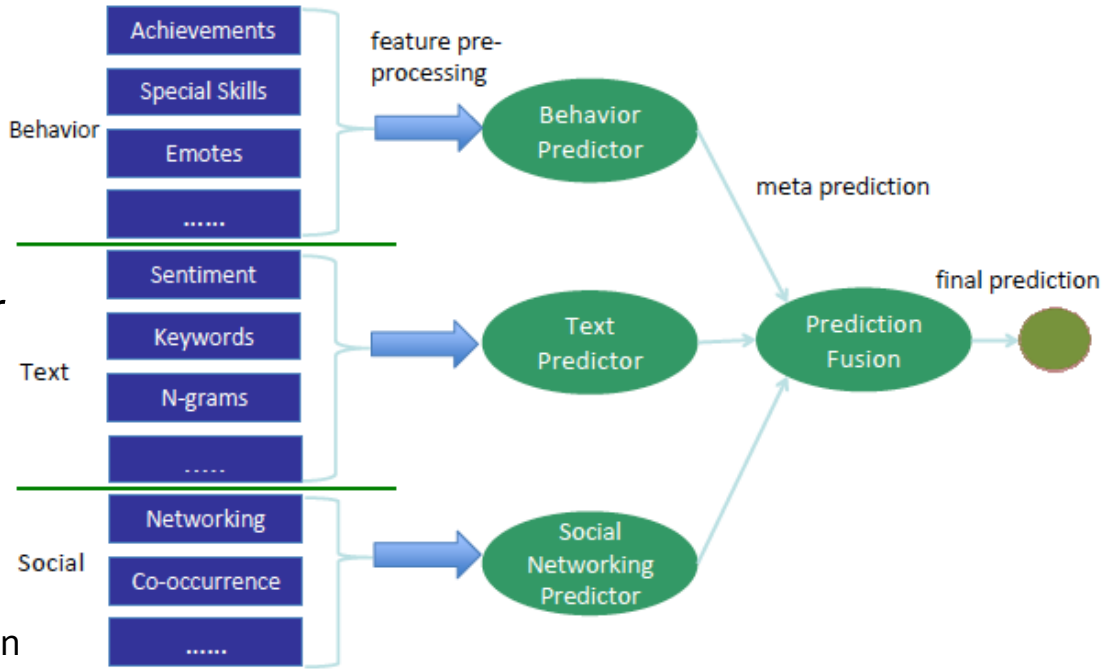
Yee, N.; Ducheneaut, N.; Nelson, L.; Likarish, P. (2011). **Introverted elves and conscientious gnomes: The expression of personality in World of Warcraft.** ACM CHI Conference on Human Factors in Computing Systems (May 7-12), Vancouver, BC, Canada.

5. The Next Frontier in IPS Assessment?

5.1. Interacting Bodies in Virtual Worlds

Inferring Personality from Online Player Predictors

- Developed algorithm to infer a personality profile
- Fused analytical predictions from multiple sources
  - Behavioral traces
  - Textual data
  - Social networking information
- *Applied and validated with over 1K WoW players*



Shen, J., Brdiczka, O., Ducheneaut, N., Yee, N., & Begole, B. (2012). Inferring personality of online gamers by fusing multiple-view predictions. In User Modeling, Adaptation, and Personalization (pp. 261-273). Springer Berlin Heidelberg.

POINT 1. Assessments using digital traces in virtual worlds might be adaptable for IPS.

5. The Next Frontier in IPS Assessment?

5.2. *Reading the Face and the Body*

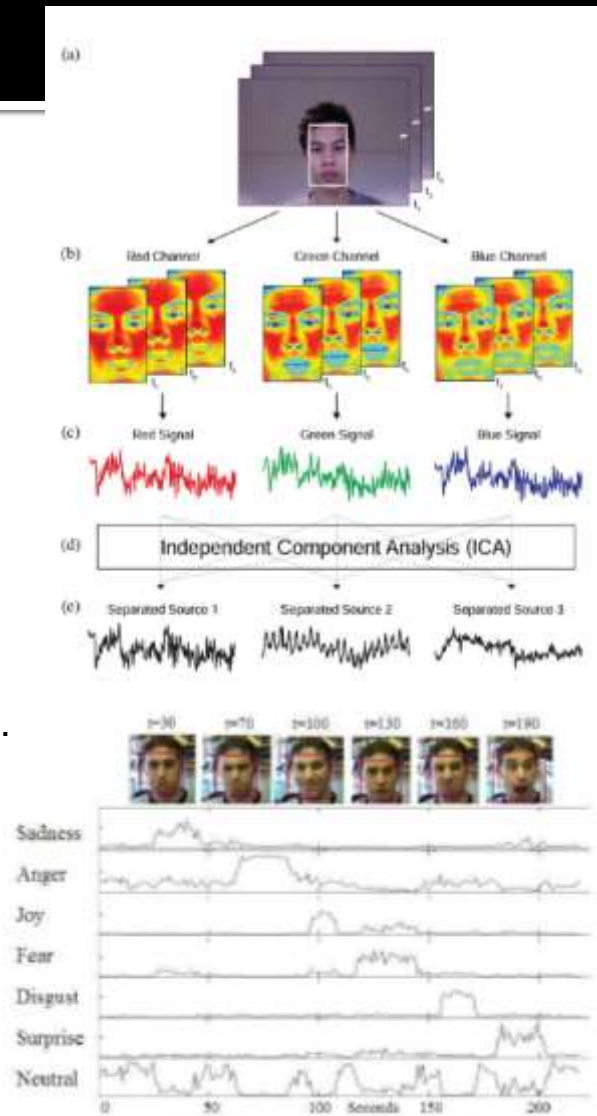
From the Computer and Engineering Sciences

- **Arousal measured automatically via face RGB**
  - Analyze color channels in video to extract blood volume pulse
    - Non-intrusive measures of heart rate and respiratory rate
  - Heart respiratory rate and variability were quantified and compared to measurements FDA-approved sensors

Poh, McDuff, & Picard (2011). Advancements in Noncontact, Multiparameter Physiological Measurements Using a Webcam. *IEEE Transactions on Biomedical Engineering, 58, 1,* 7-11.

- **Valence automatically coded via facial expressions**
  - Video frames scanned in real-time to detect upright-frontal faces.
  - The faces found are scaled and passed to a recognition engine
  - Codes facial expressions into 7 dimensions in real time:
    - **neutral, anger, disgust, fear, joy, sadness, surprise.**

Littlewort, Bartlett, Fasel, Susskind, Movellan (2004). Dynamics of Facial Expression Extracted Automatically from Video. Conference on Computer Vision and Pattern Recognition. Volume 5.



POINT 2. Methods adaptable for studying relation between affective elements of IPS and effectiveness.

5. The Next Frontier in IPS Assessment?

5.3. Real-time Analyses of Interacting Bodies and Voices

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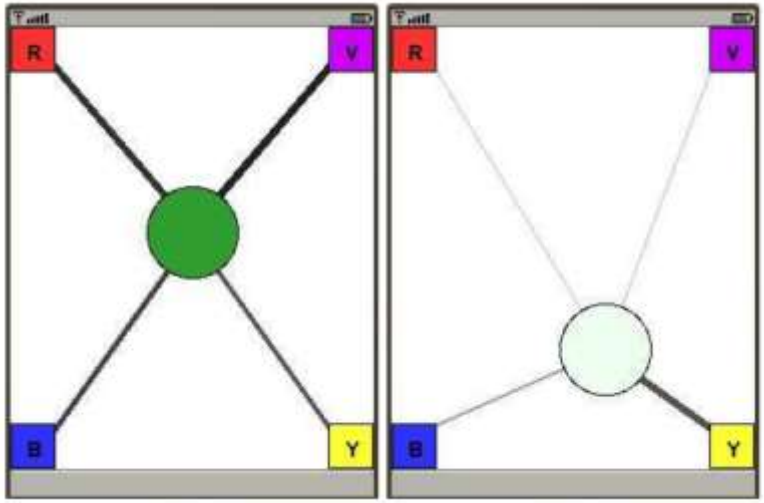
Sociometric Analyses

- Real-time analyses of social interactions using "sociometric badges"
- Measures include:
  - Proportion of speaking time
  - Average speech segment length
  - Variation in speech volume
  - Variation in body movement



Develops Visualization for Real-Time Feedback

- Visualization on left/right shows balanced/not and highly-interactive/less-interactive
- Circle position denotes balance in participation
- Line thickness denotes speaking time

Kim, T., Chang, A., Holland, L., & Pentland, A. S. (2008, November). Meeting mediator: Enhancing group collaboration using sociometric feedback. In Proceedings of the 2008 ACM conference on Computer supported cooperative work (pp. 457-466). ACM.

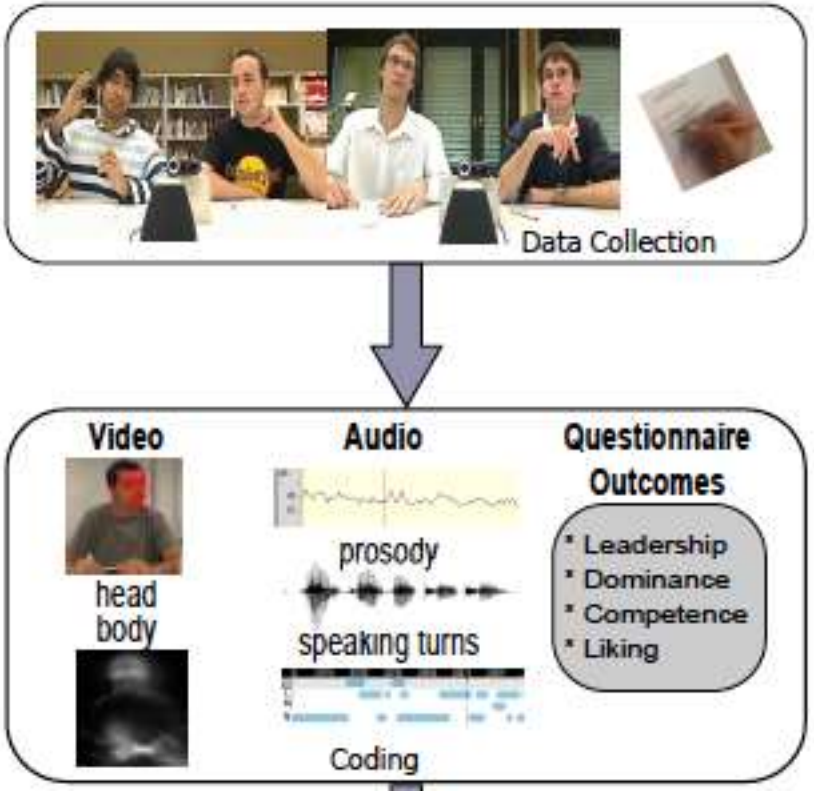
POINT 3. Developing technologies can be used to automatically assess forms of interaction indicative of effective IPS.

5. The Next Frontier in IPS Assessment?

5.3. Real-time Analyses of Interacting Bodies and Voices

Automatic Detection of Group Behavior

- Computational Framework
  - Infer emergent leadership from nonverbal behavior
  - Combines speaking turns, prosodic features, visual activity, and motion
- Team Member Perceptions
  - Perception of competence most influence by head activity and pitch
  - Perceived liking most influence by speaking turn



Sanchez-Cortes, D., Aran, O., Mast, M. S., & Gatica-Perez, D. (2012). A nonverbal behavior approach to identify emergent leaders in small groups. *IEEE Transactions on Multimedia*, *14*(3), 816-832.

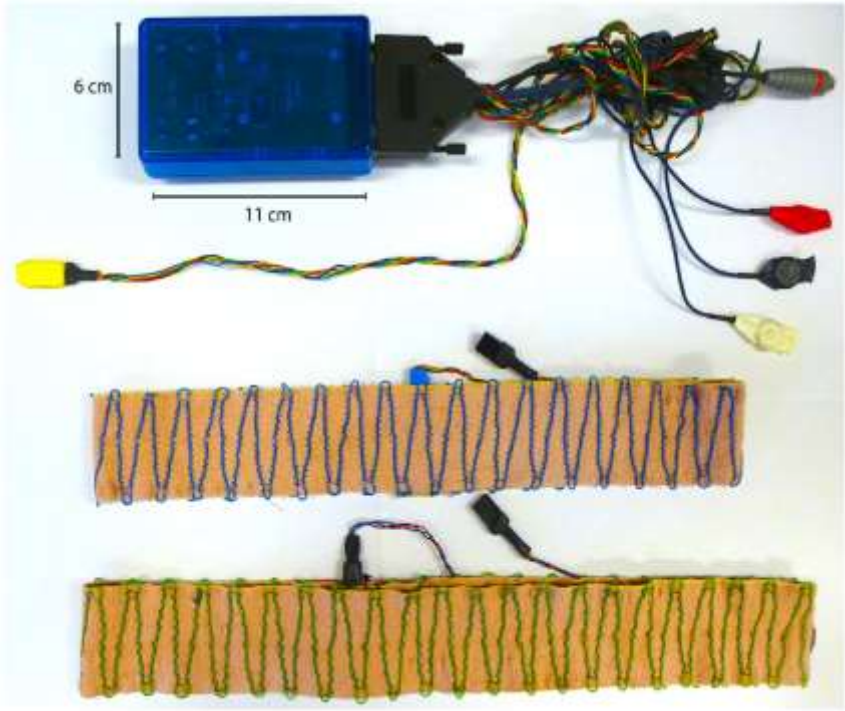
POINT 4. Non-invasive methods show promise for assessing IPS during interactions.

5. The Next Frontier in IPS Assessment?

5.4. Real-time Analyses of Interacting Bodies and Brains

Group Synchronization of Movements and Respiratory Rhythms

- Investigated synchronization of movement and of autonomic variables within a group
  - Cyclical action within group results in spontaneous motor synchronization
  - Collective synchronization also involves the respiratory rhythms
  - Participants found to breathe together
  - Participants even found to breathe together at rest.
- *All in the absence of explicit instructions about reciprocal coordination*



Codrons E, Bernardi NF, Vandoni M, Bernardi L (2014) Spontaneous Group Synchronization of Movements and Respiratory Rhythms. PLoS ONE 9(9): e107538. doi:10.1371/journal.pone.0107538

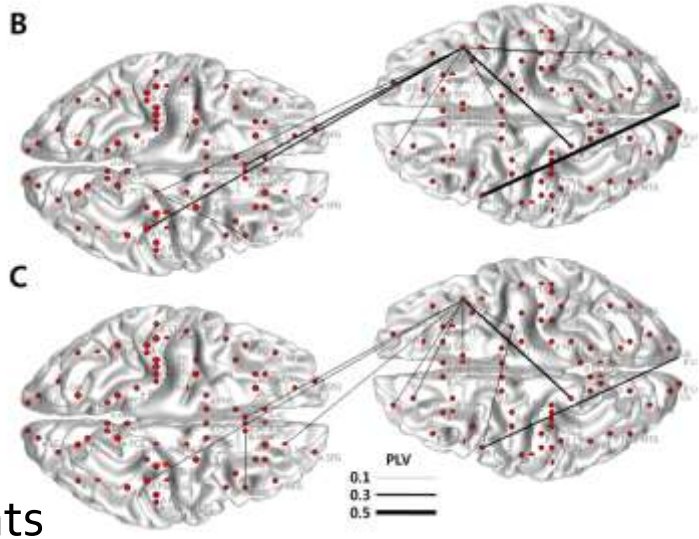
POINT 5. Potentially indicative of coordination processes during collaborations.

5. The Next Frontier in IPS Assessment?

5.4. Real-time Analyses of Interacting Bodies and Brains

Neural Correlates of Social Synchronization

- Changes in body movement synchrony as index of implicit interpersonal interaction
  - Assessed the underlying neural correlates and functional connectivity within brain regions
  - Found that **synchrony** of body movement and **neural activity** increased after **cooperative interaction**



- Phase synchrony connections between participants
  - Left is leader and Right is follower - contrasting post- against pre-training
  - Inter-brain connections found in areas implicated in social cognitive processes playing role in interpersonal awareness and empathy.
- Interpersonal synchrony may be tool for identifying neural correlates of social interaction

Yun, K., Watanabe, K., & Shimojo, S. (2012). Interpersonal body and neural synchronization as a marker of implicit social interaction. Scientific Reports, 2, 959. doi: 10.1038/srep00959

POINT 6. Developing technologies (BRAIN Initiative) may identify neural signatures of IPS for assessments during interactions.

Summary

- Why should we assess interpersonal competencies in higher education?
  - *Because employers say it is needed*
  - *It helps make for better problem solvers and decision makers*
- Which competencies have been shown to be important for learning academic content in higher education?
  - *Collaborative competencies embedded within active learning approaches*
  - *BUT, must measure learning of collaboration competencies as well as content (traditional and cutting edge approaches available)*
- Which assessment purposes are most important or valuable
  - *Formative assessment to guide instruction (peer evaluations and real-time feedback)*
  - *Assessment for research on instruction and learning (must study how cutting edge tech can better deliver real-time assessment)*

Thank You!

Questions or Comments?

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