Measuring soft skills through mobile games

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1. Rationale for game-based measures:
   - Soft skills are important, teachable
   - Traditional measures are subject to bias
   - Enacted behaviors require enacted assessments

2. RTI work on mobile soft skill assessment
   - Our foci: Problem-solving and conscientiousness
   - Our methods:
   - Our findings:
Rationale for game-based measures of soft skills
Rationale: Soft skills are important and teachable

- **Soft skills are important**
  - “Measures of personality predict…performance on achievement tests, and, to a lesser degree, performance on intelligence tests” (Almlund et al. 2011: 127)
  - Data from British NCDS shows that 1 standard deviation increase in collection of antisocial skills and behaviors is associated with a 3.3% decrease in earnings at age 42 (Carneiro, Crawford & Goodman, 2007)

- **Soft skills are teachable**
  - 2011 meta-analysis: across 213 school-based programs designed to teach soft skills (kindergarten through high school), participants showed “significantly improved social and emotional skills, attitudes, behavior, and academic performance that reflected an 11 percentile point gain in achievement” (Durlak et al. 2011)
  - 2017 meta-analysis: over 82 interventions involving 97,000+ students, participants continued to show greater SEL competencies, more prosocial behavior, fewer conduct problems, less emotional distress (Taylor et al. 2017)
Examples of bias found in self-report questionnaires:

- **Social desirability**: Respondents’ answers are influenced by what they intuit to be a socially desirable response (Nederhof, 1985; Fisher, 1993)
- **Consistency motif**: Individuals want to maintain a (perceived) consistent line through a series of answers (Podsakoff & Organ, 1986)
- **Response-shift**: An intervention changes the individual’s evaluation standard (Howard, 1980; Drennan & Hyde, 2008)
- **Fading affect bias**: Information regarding negative emotions is forgotten more quickly than information from positive emotions (Walker et al. 1997; Walker et al. 2003)
- **Recency and primacy effects**: Responses or evaluations are affected by information presented at the beginning of a time period or process (primacy) or the most recent information (recency) (Jones & Goethals, 1972)
- **Stimulus setting**: The context in which the questionnaire is administered can influence responses through conscious or subconscious cues (Podsakoff & Organ, 1986)
- **Reference bias**: Responses are influenced by different comparison standards (West et al. 2016)
“The skills considered most essential in our modern societies are often called 21st century skills. Problem solving is clearly one of them. Students will be expected to work in novel environments, face problems they have never seen and apply domain-general reasoning skills that are not tied to specific contents. Computerized dynamic problem solving can be used to create just such an interactive problem situation in order to assess these skills.”

Csapo & Funke (2017)

“New technologies permit us to administer formative assessments during the learning process, extract ongoing, multifaceted information from a learner, and react in immediate and helpful ways. When embedded assessments are so seamlessly woven into the fabric of the learning environment that they are virtually invisible, we call this *stealth assessment*.”

Shute et al. (2009: 299)

**Hypothesis**: Skills that are exhibited through behaviors (and are not mental constructs or self-perceptions) can be best measured by simulated tasks that evoke these behaviors.
RTI work on mobile soft skill assessment
To develop an authentic and valid game-based assessment of selected soft skills for use with youth that will inform educational programming.
Our methods

- **Evidence-centered design:** Systematic means of identifying what constructs to assess, what behaviors/performances reveal them, how they will be captured, and how to score them (Mislevy, 2013)

- **Game-based assessment:** Skills are assessed through context-specific simulations

- **Stealth assessment:** Data on behaviors/choice captured during simulation (Shute & Ke, 2012)

- **Mobile technology:** Assessments are run & data collected on mobile tablets

- **Part of larger assessment strategy:** Can be combined with cognitive assessments, surveys
What is problem-solving?

- Organizing and using domain-specific knowledge to identify and test solutions to non-routine problems
- Framework includes 4 components:
  - Cognitive (e.g., domain-specific knowledge)
  - Characteristics of the learner (e.g., processing speed, crystalized & fluid intelligence, creativity)
  - Metacognitive (e.g., Identify problem, devise & enact solution plan, time management, control of basic skills)
  - Motivational (e.g., performance interpretation and attribution, physiological state, individual interest, situational interest)

Why focus on problem-solving?

- Featured in most lists of 21st Century competencies (Partnership for 21st Century Skills, OECD Framework, National Research Council, USAID, etc.)
- “...Demand is growing for expert thinking (non-routine problem solving)” (Pellegrino & Hilton, 2012; see also Lippman et al, 2015)
Assessment module 1: Description and scenario

Scenario:
- You are left home alone and must take care of 2 younger siblings.

Chores:
- Plan and make breakfast, lunch, and dinner
- Clear the table & wash dishes
- Clean the house
- Feed the animals (cat & chickens)

Avoid distractions:
- Neighbors who want to play
- Chasing chickens
- Playing with the cat
Variation in performance
- Game variables capture variation in the assessed population

Predictive validity
- Game-based measures of task completion (e.g., finding and cleaning dirty spots) significantly associated with reading and mathematics performance
- Measures of problem identification (e.g., detecting a sibling is hungry and needs food) significantly associated with reading achievement
Assessment module 2: Focus = Conscientiousness

What is conscientiousness?
- A spectrum of constructs that describe individual differences in the propensity to be self-controlled, responsible to others, hard-working, orderly, and rule-abiding
- 5 prioritized facets: Industriousness, self-control, orderliness, punctuality, & responsibility

Why focus on conscientiousness?
- “Conscientiousness has been linked to a myriad of positive outcomes across educational, health, and personnel psychology, and appears to be the personality trait with the most predictive utility” (MacCann, Duckworth & Roberts, 2009; see also: Barrick & Mount, 1991; Bogg & Roberts, 2004; Poropat, 2009).
- “Measures of personality predict a range of educational outcomes. Of the Big Five, Conscientiousness best predicts overall attainment and achievement…” Conscientiousness predicts college grades to the same degree that SAT scores do.: (Pellegrino & Hilton, 2012)
- Predicts health outcomes (Roberts et al, 2004, 2012)
Next steps for game-based assessment

- Using evidence-centered design process to develop assessment framework for conscientiousness game module
- User & feasibility testing with game modules and cognitive assessments
- Full pilot study
- Integration of assessment methodology into current educational project
More Information

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