Fostering Learning Solutions: Evidence Centered Design and Scalable Technologies

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Next Gen College and Career Readiness
R&D Agenda

- Cross-cutting capabilities:
  - Collaborative problem solving
  - Creative thinking
  - Computational thinking
- Early childhood
- Adaptive learning
- Empowering learners
- Building learning science community at ACT and beyond
Early Childhood

Opportunities
• Rapid learning and development
• Open to change
• Bigger benefit from early intervention

Challenges
• What do kids need?
  ➢ Unclear learning progressions
  ➢ Lacking construct coherence
• What can kids do?
  ➢ Ratings by others
  ➢ Performance tasks
Early Childhood

• New capabilities with technology
• Target executive function, self-regulation
  • Organizing behavior toward an over-arching goal
  • Adjusting and responding to interactions with others
• Authentic assessment: semi-structured games and activities
  • Observe behaviors across activities and over time
  • Identify patterns that predict best learning outcomes
  • Scaffold and provide opportunity for practice
Early Childhood
Personalization, Adaptation, Recommendation

- Diagnostic modeling and modeling learning
  - 1PL IRT, LLTM
  - Log-linear compensatory models of learning (AFM, PFA)
  - Bayesian (BKT, iBKT)
  - Rating systems (Elo, Urnings)
- Developing and calibrating models
  - Fitting hyper-parameters
  - Extending state-of-the-art models
- Delivering adaptive value at scale with RAD API
  - Algorithms for Change (with SmartSparrow)
  - ACT Academy (with OpenEd)
Working with metadata

Michael Yudelson, Sr. Research Scientist, Learning Solutions Team

- Improving Q-matrix
  - Automating content and item indexing (with OpenEd)
- Incorporating non-cognitive constructs
  - 21st century skills, Cross-Cutting Capabilities, Behavioral, Affective
  - Computational validation
  - Automating detection & tracking of affective cues

- Holistic Framework

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  - Standards Collection
  - Standards Section
  - Subject
  - Domain
  - Strand
  - Substrand
  - Substrand Level
  - Area
  - Plane Figures
  - Geometry and Measurement
  - Math
  - Core Academics
  - Holistic Framework

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Learning and assessment design

Skills based on a competency model:
- Understanding the Problem
- Knowing Your Team
- Being Inclusive
- Having a Good Plan
- Engagement
Rich tasks and adaptive branching

**Multiple virtual agents** allows for the inclusion of diversity among teammates.

**Branching** allows for “real-time” intervention and feedback for low proficiency responses.
Engaging user experience

**Multimedia** elements (e.g., audio, video, PDF, images) allows for the inclusion of a range of extended materials to support learning and collaboration.

**Chat Environment** foster authentic student experiences.
Embedded automated scoring

**Skill Weighting** allows for differentiation based on difficulty or cognitive complexity of a node (e.g., higher weight for more complex challenges)

**Response Scoring** allows for a range of item types (MCQ, open-ended) and scoring options (e.g., partial credit)
Real-time feedback

Virtual Responses provide real-time formative feedback from both peers and advisors/teachers.

Reporting
Automated scoring allow for real-time reporting and actionable materials that facilitate insights beyond the “numbers”.
ACTNext Learning Solutions Group

Thank you!