Changing Higher Education

Art Graesser
Core Themes

• Deep learning and 21\textsuperscript{st} century skills
• Adaptive, intelligent learning environments
• Life long learning and career planning
Deeper Learning
(Anderson & Krathwohl, 2001; Bloom, 1986)

- Systems thinking
- Problem solving
- Good questions
  - Why, How, What-if, What-if-not?
- Critical stance
  - Who is the author?
  - Is the author trustworthy?
  - Is that statement correct?
21st Century Skills

• **Digital Fluency.** Planning, selecting, evaluating, organizing, communicating results

• **Deep comprehension and reasoning.** Handling technical material, inferences, metacognition, integrating information from multiple documents, detecting misinformation, critical stance

• **Communication.** Alternative media, collaboration

• **Problem solving.** Individually and in teams

• **Self-regulation.** Learning, emotions, and life

• **Global competency.**
Skills in Demand over Years
(Levy & Murnane, 2004)
International Assessments of Problem Solving

• Program for International Assessment of Adult Competencies (PIAAC, ages 16 to 65, 70 countries)
  - Adaptive Problem Solving (2021)

• Program for International Student Assessment (PISA, 15 year olds)
  – Complex Problem Solving 2012
  – Collaborative Problem Solving 2015 (served as Chair)
Correlation between labour productivity and the use of reading skills at work (OECD)

GDP per hour worked (in USD)

Use of reading skills at work

- **Correlation** between labour productivity and the use of reading skills at work (OECD)

- **GDP per hour worked (in USD)**

- **Use of reading skills at work**

- **Countries included**:
  - Australia
  - Austria
  - Canada
  - Czech Republic
  - Denmark
  - Estonia
  - Finland
  - Germany
  - Ireland
  - Italy
  - Japan
  - Korea
  - Netherlands
  - Norway
  - Poland
  - Slovak Republic
  - Spain
  - Sweden
  - United States

- **Values**:
  - GDP per hour worked: 3.0, 3.2, 3.4, 3.6, 3.8, 4.0, 4.2, 4.4, 4.6
  - Use of reading skills at work: less, more
Important Learning Technology Features

- Interactivity
- Adaptivity
- Conceptual feedback
- Open-ended input
- Choice & self-regulated learning
- Nonlinear access to information
- Linked representations
- Communication with experts and peers
# ePAL Vision

**electronic Personal Assistant for Learning**

<table>
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<tr>
<th>24x7 Agents as Tutor &amp; Mentor</th>
<th>Maintains Learner Record</th>
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<tr>
<td>Animated conversational agent</td>
<td>Demographic data</td>
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<tr>
<td>Intelligent human-computer interface</td>
<td>Subject matter knowledge</td>
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<td>Intelligent sensing</td>
<td>Performance on tests</td>
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<tr>
<td>Intelligent recommended next steps</td>
<td>Cognitive/metacognitive abilities</td>
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<td></td>
<td>Motivation and emotion</td>
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<td>Personality traits</td>
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<tr>
<th>Large Courseware Repositories</th>
<th>Intelligent Action Selection</th>
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<tr>
<td>Intelligent tutoring systems</td>
<td>Next learning environment and problem</td>
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<td>Computer-based training, MOOCs</td>
<td>Next dialogue act:</td>
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<td>Multimedia</td>
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<td>Interactive simulation</td>
<td>Question</td>
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<td>Games</td>
<td>Distributed over time</td>
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PAL3 is a computerized personal assistant to a learner to:

- Keep a life-long learning record of performance & goals
- Prevent skill decay across transitions
- Estimate learner progress and mastery
- Adaptively sequence different learning resources
Introducing

PAL3
Personal Assistant for Life Long Learning
Questions for Discussion

• What are the important 21st century skills that are being developed in higher education?

• How can technology fill the gap?

• How do we help college students become self-regulated learners and life planners?

• What are the benefits, liabilities and challenges in tracking fine-grain information about students over years?