Augmenting Human Intellect & Learning Capacity

21st Century Learning

One-to-One Technologies
Defining Mobile Devices

• Three key characteristics:
  • Ubiquity
  • Intimacy
  • Embeddedness

• Two metaphors:
  • The Lively Sketchbook
  • The Curiosity Amplifier
Substitution
Tech acts as a direct tool substitute, with no functional change

Augmentation
Tech acts as a direct tool substitute, with functional improvement

Modification
Tech allows for significant task redesign

Redefinition
Tech allows for the creation of new tasks, previously inconceivable

Podcasts on iTunes U: http://tinyurl.com/aswemayteach
<table>
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<tr>
<th>Social</th>
<th>Mobility</th>
<th>Visualization</th>
<th>Storytelling</th>
<th>Gaming</th>
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<tbody>
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<td>200,000 years</td>
<td>70,000 years</td>
<td>40,000 years</td>
<td>17,000 years</td>
<td>8,000 years</td>
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21st Century Learning (Mishra & Kereluik)

- **Foundational Knowledge**
  - Core Content Knowledge
  - Information Literacy
  - Cross-Disciplinary Knowledge/Synthesis

- **Meta Knowledge**
  - Problem Solving & Critical Thinking
  - Communication & Collaboration
  - Creativity & Innovation

- **Humanistic Knowledge**
  - Life & Job Skills
  - Cultural Competence
  - Ethical & Emotional Awareness
Bloom’s Taxonomy (Revised)  
(Anderson and Krathwohl, 2001)

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<th></th>
<th>Remember</th>
<th>Understand</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
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<tr>
<td><strong>Factual Knowledge</strong></td>
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<td><strong>Conceptual Knowledge</strong></td>
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<td><strong>Procedural Knowledge</strong></td>
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<td><strong>Meta-Cognitive Knowledge</strong></td>
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## Critical Thinking: Cognitive Skills and Subskills

<table>
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<tr>
<th>Skill</th>
<th>Subskills</th>
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| Interpretation | • Categorization  
|              | • Decoding Significance  
|              | • Clarifying Meaning   |
| Analysis     | • Examining Ideas  
|              | • Identifying Arguments  
|              | • Analyzing Arguments   |
| Evaluation   | • Assessing Claims  
|              | • Assessing Arguments   |
| Inference    | • Querying Evidence  
|              | • Conjecturing Alternatives  
|              | • Drawing Conclusions   |
| Explanation  | • Stating Results  
|              | • Justifying Procedures  
|              | • Presenting Arguments   |
| Self-Regulation | • Self-examination  
|               | • Self-correction   |

Understanding Science: How Science Works

EXPLORATION AND DISCOVERY
- Making observations
- Asking questions
- Sharing data and ideas
- Finding inspiration
- Exploring the literature

TESTING IDEAS
- Gathering data
- Interpreting data
- Supporting, contradictory, surprising or inconclusive data may...
  - support a hypothesis.
  - oppose a hypothesis.
  - inspire revised/new hypotheses.
- Actual results/observations
- Expected results/observations

BENEFITS AND OUTCOMES
- Develop technology
- Address societal issues
- Build knowledge
- Satisfy curiosity
- Solve everyday problems

COMMUNITY ANALYSIS AND FEEDBACK
- Feedback and peer review
- Replication
- Discussion with colleagues
- Publication
- Coming up with new questions/ideas
- Theory building

New technology
Practical problem
Curiosity
Serendipity
Surprising observation
Personal motivation

How science works
www.understandingscience.org
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It is imperative that the CCSS be considered the “floor”—not the “ceiling”—when it comes to expectations for student performance in the 21st century.
Using the *Framework for K-12 Science Education*

• **Core Idea PS4: Waves and their Applications in Technologies for Information Transfer**
  - PS4.A: Wave Properties
    - *What are the characteristic behaviors and properties of waves?*
  - PS4.B: Electromagnetic Radiation
    - *What is light?*
    - *How can one explain the varied effects that involve light?*
    - *What other forms of electromagnetic radiation are there?*
  - PS4.C: Information Technologies and Instrumentation
    - *How are instruments that transmit and detect waves used to extend human senses?*
Observe Waves
Basic Waves
Math Waves
Measuring Waves
Flipping the Classroom: Finding & Creating Resources
Flipping the Classroom: ConcepTests

Brief Lecture or Group Discussion (~10 minutes)

ConcepTest (~1-2 minutes)

- Fewer than 30% of students answer correctly
  - The instructor revisits and explains the concept

- Between 30-75% of students answer correctly
  - Peer Discussion: students try to convince each other (~2-3 minutes)

- More than 75% of students answer correctly
  - The instructor explains remaining misconceptions

ConcepTest (~1-2 minutes)

Which of these scenarios does not describe an acceleration?

A. A car going round a circular racetrack at constant speed.

B. A car traveling on a straight racetrack at constant speed.

C. A stone falling from the top of a building.

D. A simple pendulum.
Additional Resources – Part I

**Augmenting Human Intellect & Learning Capacity:**


**SAMR and TPCK:**

Additional Resources – Part II

**Defining Mobile Devices/The Lively Sketchbook:**

**The Curiosity Amplifier:**

**Technology In Education: The First 200,000 Years:**
Additional Resources – Part III

21st Century Learning, Bloom's Taxonomy and Critical Thinking:

Science for Students:
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