SAMR and the EdTech Quintet: Pragmatic Approaches and New Directions

Ruben R. PuenteDura, Ph.D.
1. Starting Out
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

Ruben R. Puentedura, *As We May Teach: Educational Technology, From Theory Into Practice*, (2009)
Step 1
The teacher provides a description, explanation, or example of the new term

Step 2
Students restate the explanation of the new term in their own words

Step 3
Students create a nonlinguistic representation of the term

Step 4
Students do activities that help them add to their knowledge of vocabulary terms

Step 5
Students are asked to discuss the terms with one another

Step 6
Students are involved in games that allow them to play with the terms
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African-American's achievements add up to a building named after her

Computers have not always been small. They haven't always been fast or reliable. In the 1960s, humans could often do the job better.

Katherine Johnson was one of the "human computers" hired to perform critical and challenging calculations for NASA's early space flights. The National Aeronautics and Space Administration (NASA) is the United States' space agency and part of the government.

Johnson was not known to the public until last year, but all changed.
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<table>
<thead>
<tr>
<th>Meta-analysis</th>
<th>Number of studies</th>
<th>ES type</th>
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<tr>
<td>Y.-I. Liao and Chen (2005)</td>
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<td>Roblyer, Castine, and King (1988)</td>
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<tr>
<td>Rosen and Solomon (2007)</td>
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<td>Hedges’s g</td>
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<td>Cohen’s d</td>
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<tr>
<td>Soe, Koki, and Chang (2000)</td>
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<td>Hedges’s g</td>
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<td>Timmerman and Kruepke (2006)</td>
<td>114</td>
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<td>0.24</td>
<td>0.03</td>
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<td>Torgerson and Elbourne (2002)</td>
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<td>Waxman, Lin, and Michko (2003)</td>
<td>42</td>
<td>Glass’s Δ</td>
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<td>Yaakub (1998)</td>
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<td>0.05</td>
</tr>
<tr>
<td>Zhao (2003)</td>
<td>9</td>
<td>Hedges’s g</td>
<td>1.12</td>
<td>0.26</td>
</tr>
</tbody>
</table>

a. Converted to Cohen's d.

**SAMR and the Use of Technology to Enhance Reading Performance in Middle School**

![Effect Size Chart](chart.png)

- **S** - 5 Studies
- **A** - 4 Studies
- **M** - 8 Studies
- **R** - 3 Studies
SAMR and the Use of Tablets in Education

Effect Size

S - 14 Studies
A - 7 Studies
M - 4 Studies
R - 2 Studies

Choosing the First SAMR Ladder Project: Three Options

• **Your Passion:**
  - If you had to pick one topic from your class that best exemplifies why you became fascinated with the subject you teach, what would it be?

• **Barriers to Your Students’ Progress:**
  - Is there a topic in your class that a significant number of students get stuck on, and fail to progress beyond?

• **What Students Will Do In the Future:**
  - Which topic from your class would, if deeply understood, best serve the interests of your students in future studies or in their lives outside school?
2. Shared Practices and Deep Learning
<table>
<thead>
<tr>
<th>Social</th>
<th>Mobility</th>
<th>Visualization</th>
<th>Storytelling</th>
<th>Gaming</th>
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<tbody>
<tr>
<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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</tbody>
</table>

Class

School

World

Learning Environments

Home

Homework

Contextual Search/Augmented Reality
Sensors/Recorders
Mobile Tools
Cloud Resources

The Curiosity Amplifier

The Lively Sketchbook

Formal Definition of **Game** (Salen & Zimmerman)

“A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.”

<table>
<thead>
<tr>
<th>The EdTech Quintet – Associated Practices</th>
</tr>
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<tbody>
<tr>
<td><strong>Social</strong></td>
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</tr>
<tr>
<td><strong>Gaming</strong></td>
</tr>
</tbody>
</table>
The Value of Shared Practices

- Augmented Note Taking and Annotation
- Visualization Methods:
  - 5 Primary Domains: Space, Time, Networks, Text, Number
- Simple Blogging
- Simple Digital Storytelling Video
- Flipped Classroom:
  - Materials Creation
  - Peer Discussion/Instruction Methods
- Simple Interactive Fiction
- LMS Practices
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**Extended Thinking**

**Strategic Thinking**

**Skills and Concepts**

**Recall and Reproduction**

Webb, Norman L. Depth-of-knowledge levels for four content areas. (2002)
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**Skills and Concepts**
Examine the leaves - are they crisp and fresh, or do they show wilting?
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<th>Create</th>
<th>Evaluate</th>
<th>Analyze</th>
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<tr>
<td>Apply</td>
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</tr>
<tr>
<td>Understand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remember</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recall &amp; Reproduction</td>
<td>Skills &amp; Concepts</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Remember</td>
<td>S</td>
<td>A</td>
</tr>
<tr>
<td>Understand</td>
<td>S/A</td>
<td>A</td>
</tr>
<tr>
<td>Apply</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Analyze</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Evaluate</td>
<td>M/R</td>
<td>M/R</td>
</tr>
<tr>
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<td>R</td>
<td>R</td>
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3. Interweaving Content, Pedagogy, and Technology
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Refraction

- Pick:
  - A Content Area
  - A 21C Learning Skill
  - A Shared Practice
- Create a SAMR Ladder that looks at a topic in 1. through the lens of 2., focused into actual practice by 3.
<table>
<thead>
<tr>
<th>Competency Concept</th>
<th>Evaluate Historical Accounts</th>
<th>Interpret Primary Sources</th>
<th>Apply Chronological Reasoning</th>
<th>Contextualize</th>
<th>Construct Acceptable Historical Accounts</th>
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</thead>
<tbody>
<tr>
<td>History as an Interpretive Account</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Relationship of Past and Present</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Historical Evidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Complex Causality</td>
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<tr>
<td>Significance</td>
<td></td>
<td></td>
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4. Integrating Formative Assessment
“Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited.”

Black and Wiliam: Defining Formative Assessment

Wiliam: A Framework for Formative Assessment

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is right now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>1 Clarifying learning intentions and criteria for success</td>
<td>2 Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding</td>
<td>3 Providing feedback that moves learners forward</td>
</tr>
<tr>
<td>Peer</td>
<td>Understanding and sharing learning intentions and criteria for success</td>
<td>4 Activating students as instructional resources for one another</td>
<td></td>
</tr>
<tr>
<td>Learner</td>
<td>Understanding learning intentions and criteria for success</td>
<td>5 Activating students as the owners of their own learning</td>
<td></td>
</tr>
</tbody>
</table>
Clarifying, Sharing, and Understanding Learning Intentions and Criteria for Success

• Rubric Dichotomies:
  • Task-specific vs. generic rubrics
  • Product-focused vs. process-focused
  • Official vs. student-friendly Language

• Rubric Design:
  • Three key components in presenting learning intentions and success criteria to students:
    • WALT: we are learning to
    • WILF: what I'm looking for
    • TIB: this is because
  • Make explicit progressions within rubrics, and progressions across rubrics

• Students and Rubrics:
  • Have students look at samples of other students' work, then rank them by quality
    • Students become better at seeing issues in their own work by recognizing them in others’ work
    • Not a “somebody wins” exercise, but rather a quality exercise that engages students
  • Have students design test items, rubrics
Rubric Example #1: A Classical Rubric for Concept Maps
(M. Besterfield-Sacre et al., 2004)

Table 4. Concept Map scoring rubric (Understanding of Engineering Field).

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensiveness –</td>
<td>The map lacks subject definition; the knowledge is very simple</td>
<td>The map has adequate subject definition but knowledge is limited</td>
<td>The map completely defines the subject area. The content lacks no more than one extension area (i.e., most of the relevant extension areas including lifelong learning, employment, people, etc. are mentioned).</td>
</tr>
<tr>
<td>covering completely/broadly</td>
<td>and/or limited. Limited breadth of concepts (i.e., minimal</td>
<td>within some areas (i.e., much of the coursework is mentioned but</td>
<td></td>
</tr>
<tr>
<td></td>
<td>coverage of coursework, little or no mention of employment, and/or lifelong learning). The map barely covers some of the qualities of the subject area.</td>
<td>one or two of the main aspects are missing). Map suggests a somewhat narrow understanding of the subject matter.</td>
<td></td>
</tr>
<tr>
<td>Organization – to arrange</td>
<td>The map is arranged with concepts only linearly connected. There</td>
<td>The map has adequate organization with some within/between</td>
<td>The map is well organized with concept integration and the use of feedback loops. Sophisticated branch structure and connectivity.</td>
</tr>
<tr>
<td>by systematic planning</td>
<td>are few (or no) connections within/between the branches. Concepts</td>
<td>between branch connections. Some, but not complete, integration</td>
<td></td>
</tr>
<tr>
<td>and united effort</td>
<td>are not well integrated.</td>
<td>of branches is apparent. A few feedback loops may exist.</td>
<td></td>
</tr>
<tr>
<td>Correctness - conforming</td>
<td>The map is naïve and contains misconceptions about the subject</td>
<td>The map has few subject matter inaccuracies; most links are</td>
<td>The map integrates concepts properly and reflects an accurate</td>
</tr>
<tr>
<td>to or agreeing with fact,</td>
<td>area; inappropriate words or terms are used. The map documents</td>
<td>correct. There may be a few spelling and grammatical errors.</td>
<td>understanding of subject matter meaning little or no</td>
</tr>
<tr>
<td>logic, or known truth</td>
<td>an inaccurate understanding of certain subject matter.</td>
<td></td>
<td>misconceptions, spelling/grammatical errors.</td>
</tr>
</tbody>
</table>

Table 5. Confidence intervals for each category.
Rubric Example #2: A Rubric for Sociology Online Discussion
(S. Evans, 2010)

<table>
<thead>
<tr>
<th>Rubric Category</th>
<th>4 Points</th>
<th>2 Points</th>
<th>0 Points</th>
</tr>
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<tbody>
<tr>
<td>Content</td>
<td>You show that you can apply or extend the idea you are discussing.</td>
<td>Some of your messages analyze, interpret, or apply the material well, but some do not. This might either be because the analysis was not done well, or because it was not attempted (that is, was simply opinion or hearsay).</td>
<td>Your messages generally show little evidence of analysis, consisting instead of opinion, feelings and impressions.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>You accurately represent the concepts discussed.</td>
<td>You generally represent the concepts accurately, but you do not do so in all cases.</td>
<td>You have significant issues with regard to accurately representing the concepts.</td>
</tr>
<tr>
<td>Use of material</td>
<td>You use and cite sources, including the text and articles and/or bring in an outside source, all of which clearly add <em>significantly</em> to the discussion.</td>
<td>You clearly refer back to a definition, example or concept from the reading or lecture.</td>
<td>You do not bring in or refer to any material from the text, outside sources, or lectures.</td>
</tr>
<tr>
<td>Sociological Analysis</td>
<td>You focus on the sociological implications of the issue at hand (e.g., social meaning, the outcomes for society or groups, the social function served).</td>
<td>You touch on some sociological issues, but focus also on individual ones.</td>
<td>You focus primarily on individual issues.</td>
</tr>
<tr>
<td>Responses</td>
<td>You extend or politely question the post of another person in a way that advances the discussion.</td>
<td>You add new examples that continue the idea created by another person.</td>
<td>Your responses are primarily agreement.</td>
</tr>
<tr>
<td>Participation</td>
<td>You write at least three or more substantive comments (using the above criteria) based on the discussion assigned.</td>
<td>You write fewer than three substantive comments.</td>
<td>Your responses are primarily agreement.</td>
</tr>
<tr>
<td>Time of Posting</td>
<td>Your posts are spread widely during the discussion.</td>
<td>You post at two significantly different times.</td>
<td>Your posts are clustered within a short period of time.</td>
</tr>
<tr>
<td>Posts Read</td>
<td>You have read at least 75% of the posts in the discussion.</td>
<td>You read at least 50% of the posts in the discussion.</td>
<td>You read less than 50% of the posts in the discussion.</td>
</tr>
<tr>
<td>Clarity</td>
<td>You use standard grammar and spelling and your meaning is clear.</td>
<td>Your posts have some grammar or spelling mistakes or your meaning is not entirely clear.</td>
<td>Your posts have significant grammar or spelling mistakes or your meaning is not clear.</td>
</tr>
</tbody>
</table>
**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.
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5. Incorporating Action Research
Thick vs. Thin Approaches to Research

- **Thick Approaches:** detailed knowledge of a few cases
  - Consider multiple intertwined causes
  - Try to explain multifaceted outcomes
  - Rely on elaborate theoretical assumptions
  - Suitable for rich understanding of specific events
  - Frequently associated with qualitative analysis

- **Thin Approaches:** partial knowledge of many cases
  - Look at simple causes and outcomes
  - Rely on theoretically neutral propositions
  - Suitable for hypothesis testing and generalization
  - Frequently associated with quantitative analysis

- It is possible to thicken thin approaches by e.g. triangulation, developing quantitative indicators of qualitative concepts, nested analysis

Four Defining Characteristics of Action Research

• Practical Nature

• Change-Oriented

• Part of a Cyclical Process

• Teachers are Active Researchers and Participants

<table>
<thead>
<tr>
<th>Three Approaches to Action Research</th>
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</thead>
<tbody>
<tr>
<td><strong>Technical Action Research</strong></td>
</tr>
<tr>
<td>Improve the effectiveness or efficiency of educational practice</td>
</tr>
<tr>
<td><strong>Practical Action Research</strong></td>
</tr>
<tr>
<td>Improve the teacher’s understanding and professional development</td>
</tr>
<tr>
<td><strong>Emancipatory Action Research</strong></td>
</tr>
<tr>
<td>Improve the educational organization or system and remove obstacles to change</td>
</tr>
</tbody>
</table>

Using SAMR to Guide Teacher Professional Development

Just as SAMR can be used to guide classroom uses of technology, so it can be used to guide the use of technology in teacher PD. In the example illustrated in the slides that follow:

- **S:** PD specialist lectures are recorded and archived for future use; online materials such as eBooks are likewise added to this PD library.

- **A:** Classroom observations are recorded and annotated by the visiting teacher coach, in order to inform PD conversations, and provide an archival record of evolving teacher practice.

- **M:** Teachers engage in practical action research within the context of their classroom practice, using student observations and learning artifacts to support thick, thin, or combined research approaches.

- **R:** Teachers share the results of their action research with their fellow faculty, as well as with a wider audience, acting as mentors to both groups.
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**Extending Traditional PD**
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**Peer Coaching as PD**
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Action Research as PD
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Digital Storytelling as PD
6. Building Community
Diana Laurillard, “Pedagogical forms of mobile learning: framing research questions.” In N. Pachler (Ed.), Mobile learning: Towards a research agenda. (2007)
Communities of Practice and Personal Learning Networks

- Internally: *School as Community of Practice*
  - A **domain** of shared interest, commitment, and competence;
  - A **community** where joint activities, discussions, information sharing, and help processes are focused around and by the domain;
  - A **practice** with a shared repertoire of resources, such as experiences, stories, tools, and problem-solving approaches.

- Externally: *Individual Personal Learning Networks*
  - Loosely structured around a range of tools, individually chosen - no two PLNs are the same;
  - Usually online, but may involve face-to-face components (e.g. meetups);
  - Resources may range from professional websites, to blogs, to Facebook groups, to Twitter feeds;
  - Involvement may range from primarily reading sources, to participating in discussions, to authoring new materials.


• Zone of Proximal Development (ZPD):
  • Region between:
    • what a learner can accomplish independently (the Zone of Current Development, ZCD)
    • what they can accomplish with assistance from a “more knowledgeable other” (MKO)

• “…what a child can do with assistance today she will be able to do by herself tomorrow.”

• This is an iterative process:
  • The ZCD and ZPD change over time;
  • Independent practice (IP) is required to close the loop.
<table>
<thead>
<tr>
<th>The EdTech Quintet – Associated Practices</th>
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## The EdTech Quintet – Associated Practices

<table>
<thead>
<tr>
<th>Practice</th>
<th>Description</th>
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<tr>
<td>Social</td>
<td>Provides diversity to the ZPD</td>
</tr>
<tr>
<td>Mobility</td>
<td>Creates the context for the process</td>
</tr>
<tr>
<td>Visualization</td>
<td>Aids in segmenting ZPD, bridging gaps</td>
</tr>
<tr>
<td>Storytelling</td>
<td>Aids in the integration of the ZPD</td>
</tr>
<tr>
<td>Gaming</td>
<td>Provides frameworks for independent practice</td>
</tr>
</tbody>
</table>
seeks to emphasize the necessary future-oriented nature of imagination as a culturally-mediated psychological function. The coming-together of direct and mediated relations at the right of the triangle is replaced by a gap where phylogeny, culture, and ontogeny are momentarily reconciled so as to produce an image. This image is a condition of thought and action, for it provides the subject with a stable-enough image of the world into which thought or action has meaning. This way of diagramming the process of imagination foregrounds the question of how a subject, at a future moment in time ($t_{n+1}$), reconciles the differences between "direct" and mediated sources of knowledge, bringing into being a single and stable image of the world. We wish to emphasize that the analytic device of the triangle—here used to think about imagination as a process that unfolds at a very micro, moment-to-moment scale—can be generalized to broader conditions of imagination, as our paper will show later.

To make explicit the link between this representation of mediated thought and our discussion of imagination, consider that the gap indicates a process of resolving sources of information about the world that are heterogeneous. This "resolving activity" is akin to the process we concluded must exist from fixed-image experiments described earlier. In this regard, we think of a process occurring at time $t_n$ that results in a new image at time $t_{n+1}$ as analogous to the resolving process that occurs in the process of a saccadic eye movement. In each case, a gap is generated so that an image may emerge from resolving differences in the sources of information.

We wish to draw attention to several aspects of the "gap" where the mediational triangle is not fully connected as a way of better specifying what the process of image formation entails.

1. This gap represents a set of differences in experience that exist at a "next moment in time." These differences arise as a result of the fact that experience is conditioned by the intermingling of phylogenetically-constrained and culturally-mediated relations of the subject to the object. Each of these relations has its own heterogeneous temporal dynamics, as a consequence of which discoordination between them is a constant, necessary reality. The biological constraints on thought and action are spatially and temporally difference from those of culture or $M$ (artifact).

Six Principles:

1. The imagination serves diverse cognitive processes as an entire spectrum of activity.

2. The imagination both resolves and widens the gap between what is unfamiliar and what is known.

3. The Pragmatic Imagination pro-actively imagines the actual in light of meaningful purposeful possibilities.

4. The Pragmatic Imagination sees thought and action as indivisible and reciprocal.

5. The imagination must be instrumentalized to turn ideas into action - the entire spectrum of the imagination.

6. Because the imagination is not under conscious control, we need to understand, find, and design ways to set it in motion and scaffold it for play and purpose.