SAMR, STEM and Assessment

Ruben R. Puente, Ph.D.
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Modification
Tech allows for significant task redesign

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

Substitution
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Ruben R. Puentedura, As We May Teach: Educational Technology, From Theory Into Practice. (2009)
<table>
<thead>
<tr>
<th>Social</th>
<th>Mobility</th>
<th>Visualization</th>
<th>Storytelling</th>
<th>Gaming</th>
</tr>
</thead>
<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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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
  - ConcepTest (~1-2 minutes)

- 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)

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2. Informing Design and Assessment
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 is required to close the loop.
<table>
<thead>
<tr>
<th><strong>Consolidating</strong></th>
<th><strong>Expanding</strong></th>
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<tbody>
<tr>
<td>Consolidating understanding refers to a solid, confident facility with a given concept or skill. A consolidating learner produces exemplary work to reflect her growth. She demonstrates consistent, independent success.</td>
<td>Expanding understanding indicates a learner who has consolidated her understanding, and in addition to this, also demonstrates a capacity to reach beyond by generating unique insights and original connections. An expanding learner demonstrates novel thinking and individual initiative in exploring and using complex, interrelated ideas.</td>
</tr>
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<td><strong>Formulating</strong></td>
<td></td>
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<td>Formulating understanding represents meaningful steps forward as a learner builds upon her basic grasp of a concept or skill. A formulating learner is achieving a greater degree of independent achievement than when her understanding was first emerging.</td>
<td></td>
</tr>
<tr>
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<td>Emerging understanding is a good beginning. It indicates a learner who is working to establish her basic grasp of the concept or skill being addressed. An emerging learner may be encountering an idea or skill that is relatively new to her.</td>
<td></td>
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Surveying Seymour Papert’s Four Expectations

• **Expectation 1**: suitably designed formative/summative assessment rubrics will show improvement when compared to traditional instruction.

• **Expectation 2**: students will show more instances of work at progressively higher levels of Bloom’s Taxonomy.

• **Expectation 3**: student work will demonstrate more – and more varied – critical thinking cognitive skills, particularly in areas related to the examination of their own thinking processes.

• **Expectation 4**: student daily life will reflect the introduction of the technology. This includes (but is not limited to) directly observable aspects such as reduction in student attrition, increase in engagement with civic processes in their community, and engagement with communities beyond their own.
“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.”
### Bloom's Taxonomy: Cognitive Processes

<table>
<thead>
<tr>
<th>Anderson &amp; Krathwohl (2001)</th>
<th>Characteristic Processes</th>
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</table>
| **Remember**                 | - Recalling memorized knowledge  
- Recognizing correspondences between memorized knowledge and new material |
| **Understand**               | - Paraphrasing materials  
- Exemplifying concepts, principles  
- Classifying items  
- Summarizing materials  
- Extrapolating principles  
- Comparing items |
| **Apply**                    | - Applying a procedure to a familiar task  
- Using a procedure to solve an unfamiliar, but typed task |
| **Analyze**                  | - Distinguishing relevant/irrelevant or important/unimportant portions of material  
- Integrating heterogeneous elements into a structure  
- Attributing intent in materials |
| **Evaluate**                 | - Testing for consistency, appropriateness, and effectiveness in principles and procedures  
- Critiquing the consistency, appropriateness, and effectiveness of principles and procedures, basing the critique upon appropriate tests |
| **Create**                   | - Generating multiple hypotheses based on given criteria  
- Designing a procedure to accomplish an untyped task  
- Inventing a product to accomplish an untyped task |
# Facione: Critical Thinking – Cognitive Skills and Subskills

<table>
<thead>
<tr>
<th>Skill</th>
<th>Subskills</th>
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</table>
| 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        |
## 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>
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<tbody>
<tr>
<td><strong>Teacher</strong></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><strong>Peer</strong></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>
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<tr>
<td><strong>Learner</strong></td>
<td>Understanding learning intentions and criteria for success</td>
<td>5 Activating students as the owners of their own learning</td>
<td></td>
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</table>
1. 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
2. Eliciting Evidence of Learners' Achievement in the (Extended) Classroom

- Asking questions in class:
  - Chosen to act as a discussion/thinking trigger
  - Should provide info for varying instruction on the fly and in the long term
- Examples:
  - ConcepTest
  - POE (Predict-Observe-Explain)
  - TPS (Think-Pair-Share)
  - Virtual Whiteboard
3. Providing Feedback that Moves Learners Forward

• The feedback process must provide a recipe for future action

• Feedback should:
  • Be more work for the recipient than the donor, i.e., not just right/wrong – make them think about what did not work
  • Be focused: less is more
  • Relate explicitly to goals/rubrics

• How:
  • Scores or praise alone do not provide this; comments do
  • Supplying minimal scaffolded responses (i.e., where the student got stuck) >> supplying a full response to the problem
    • This emphasizes the crucial role of the draft object and process
  • Oral feedback >> written feedback
    • Consider using recordings
  • Create (sometimes together with students) process rubrics that embody this scaffold
  • Provide time for students to use this feedback

• Minimize grading:
  • Avoid false stopping points
  • Avoid ratchet effect
4. Activating Students as Instructional Resources for One Another

• Two key elements:
  • Group goals
  • Individual accountability

• Effectiveness due to (in order of importance):
  • Personalization
  • Cognitive Elaboration
  • Motivation
  • Social Cohesion

• Reciprocal help only works when it takes the form of elaborated explanations:
  • Not simple answers or procedures
  • Looks to the upper levels of Bloom for both participants

• Reciprocal help is more effective (by a factor of up to 4) if the product being assessed is the result of the aggregate of individual contributions, rather than just one group product
5. Activating Students as Owners of their Own Learning

• Effective self-assessment is up to twice as effective as other-assessment

• Two key components:
  • Metacognition:
    • Metacognitive knowledge: know what you know
    • Metacognitive skills: what you can do
    • Metacognitive experience: what you know about your cognitive abilities
  • Motivation:
    • Traditionally viewed as a cause (intrinsic/extrinsic), but is better viewed as an outcome:
      • Flow (M. Csikszentmihalyi): the result of a match between capability and challenge
        • Students are motivated to reach goals that are specific, within reach, and offer some degree of challenge

• Three sources of info for students to decide what they will do:
  • Perceptions of the task and its context
  • Knowledge about the task and what it will take to be successful
  • Motivational beliefs

• The role of the draft process and object resurfaces as a crucial component here

• Important Tools:
  • Learning logs and journals
  • Learning portfolios
Flow is experienced when perceived challenges and skills match; a region of the flow channel, theoretically the resolution of this phenomenological map is in reality a much more complex state of consciousness. Experientially, it is a sphere of stagnation and boredom as challenges increasingly exceed capacities for action and skills. Flow is experienced when perceived opportunities for action equal challenges and skills. Flow is experienced when perceived opportunities for action equal challenges and skills identified three regions of experience. For example, when a balance between perceived challenge and skill is achieved, the person is in the flow state. Respective to the flow concept is the idea that the closer the balance is to the center (flow), the deeper the flow experience. The closer the balance is to the periphery (anxiety, Worry), the higher the experienced anxiety. It is important to note that the flow model is not a linear function of challenge and skill. Rather, it is a complex function that takes into account the interaction between challenge and skill. The flow model is a useful tool for understanding the subjective experience of flow, and it has been used in a wide range of research studies to examine the factors that contribute to flow experiences. The flow model is based on the idea that flow is a state of consciousness characterized by a balance between perceived challenge and skill. The flow model is a useful tool for understanding the subjective experience of flow, and it has been used in a wide range of research studies to examine the factors that contribute to flow experiences.
3. Starting Points
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?
Hippasus

Blog: http://hippasus.com/rrpweblog/
Email: rubenrp@hippasus.com
Twitter: @rubenrp

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