SAMR, Learning, and Assessment

Ruben R. Puente, Ph.D.
Part 1: PCK and SAMR
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. Puenteedura, 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>
</tr>
</tbody>
</table>

History & Geography
History – Core Concepts

- Causality
- Chronology
- Multiple Perspectives
- Contingency
- Empathy
- Change and Continuity Over Time
- Influence/Significance/Impact
- Contrasting Interpretations
- Intent/Motivation
Does the question represent an important issue to historical and contemporary times?

Is the question debatable?

Does the question represent a reasonable amount of content?

Will the question hold the interest of students?

Is the question appropriate given the materials available?

Is the question challenging for the students you are teaching?

What organizing historical concepts will be emphasized?

Location
Position in space

Condition
Mix of natural & artificial features that give meaning to a location

Links
Connections between places

Formal Region
Group of places with similar conditions

Functional Region
Group of places linked together by a flow
<table>
<thead>
<tr>
<th>Spatial Thinking Skills</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison</strong></td>
<td>How are places similar or different?</td>
</tr>
<tr>
<td><strong>Aura</strong></td>
<td>What is this place’s influence on nearby places?</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td>What nearby places are similar to this one?</td>
</tr>
<tr>
<td><strong>Transition</strong></td>
<td>How do things change between two places?</td>
</tr>
<tr>
<td><strong>Hierarchy</strong></td>
<td>What larger area is this area inside? What smaller areas are inside it?</td>
</tr>
<tr>
<td><strong>Analogy</strong></td>
<td>What places have similar conditions?</td>
</tr>
<tr>
<td><strong>Pattern</strong></td>
<td>What distinctive arrangements can you see on a map?</td>
</tr>
<tr>
<td><strong>Association</strong></td>
<td>Are these patterns similar?</td>
</tr>
</tbody>
</table>
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Understanding Science: How Science Works
Understanding Science: How Science Works
Flowchart for K-2 – the E&D and CA&F bubbles should be bolder than the others as that is where most students will be working. The text should be modified to read:

**E&D:**
- Making observations
- Asking questions
- Sharing observations and ideas

**Testing:**
- Recording observations
- Interpreting observations – What is different? What is the same?
- Using observations to tell what made me think that…
- Changing what I thought after more observations

**CA&F**
- Talking about our observations and ideas
- Listening to classmates
- Having others try your investigation
- Coming up with new questions and ideas

**Benefits and Outcomes**
- Learning more
- Answering questions
- Satisfying curiosity

**Community Analysis and Feedback**
- Talking about our ideas
- Listening to classmates
- Having others try your investigation
- Coming up with new questions and ideas

This science flowchart has been modified for grades K–2.
The Art of Problem Posing: the What–If–Not Strategy

• Level 0: Choosing a Starting Point
  • This could be an object, a concrete scenario, or a theorem.

• Level I: Listing Attributes
  • What are all the key components involved in this starting point?

• Level II: What-If-Not-ing
  • What if each attribute were not so - what could it be then?

• Level III: Question Asking or Problem Posing
  • What new questions can we ask using these new alternatives?

• Level IV: Analyzing the Problem
  • We select some of these questions and try to analyze or answer them.
Thinking Mathematically

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**Rock Pigeon Data**

<table>
<thead>
<tr>
<th>Month</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>40</td>
</tr>
<tr>
<td>Oct</td>
<td>32</td>
</tr>
<tr>
<td>Nov</td>
<td>30</td>
</tr>
<tr>
<td>Dec</td>
<td>20</td>
</tr>
<tr>
<td>Jan</td>
<td>21</td>
</tr>
<tr>
<td>Feb</td>
<td>25</td>
</tr>
<tr>
<td>Mar</td>
<td>27</td>
</tr>
<tr>
<td>Apr</td>
<td>32</td>
</tr>
<tr>
<td>May</td>
<td>45</td>
</tr>
</tbody>
</table>

---

**Bar Chart**

- **Y-Axis**: Count
- **X-Axis**: Months (Sept, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May)
- **Data Series**: Rock Pigeon

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English Language Arts & Foreign Languages
# Facione: Critical Thinking – Cognitive Skills and Subskills

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<thead>
<tr>
<th>Skill</th>
<th>Subskills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpretation</td>
<td>Categorization, Decoding Significance, Clarifying Meaning</td>
</tr>
<tr>
<td>Analysis</td>
<td>Examining Ideas, Identifying Arguments, Analyzing Arguments</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Assessing Claims, Assessing Arguments</td>
</tr>
<tr>
<td>Inference</td>
<td>Querying Evidence, Conjecturing Alternatives, Drawing Conclusions</td>
</tr>
<tr>
<td>Explanation</td>
<td>Stating Results, Justifying Procedures, Presenting Arguments</td>
</tr>
<tr>
<td>Self-Regulation</td>
<td>Self-examination, Self-correction</td>
</tr>
</tbody>
</table>
Ten Strategies for Designing Critical Thinking Tasks

- Tasks linking course concepts to students’ personal experience or previously existing knowledge
- Explanation of course concepts to new learners
- Thesis support assignments
- Problem-posing assignments
- Data-provided assignments
- Template assignments
- Assignments requiring role-playing of unfamiliar perspectives or imagining “what if” situations
- Summaries or abstracts of articles or course lectures
- Dialogues or argumentative scripts
- Cases and simulations

## ACTFL Proficiency Guidelines (2012)

<table>
<thead>
<tr>
<th>Level</th>
<th>Speaking</th>
<th>Writing</th>
<th>Listening</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice</td>
<td>short messages, everyday topics, isolated words/phrases</td>
<td>lists and notes, formulaic information, words and phrases</td>
<td>key words, expressions, simple statements, recognize known phrases</td>
<td>key words, expressions, predictable texts, recognize known text</td>
</tr>
<tr>
<td>Intermediate</td>
<td>recombine material, simple questions, sentence-level language</td>
<td>simple messages, simple facts, ideas, connected sentences</td>
<td>sentence-length speech, everyday topics, controlled environment</td>
<td>loosely connected texts, basic information, straightforward texts</td>
</tr>
<tr>
<td>Advanced</td>
<td>participatory dialogue, broader topics, paragraph-level</td>
<td>routine texts, factual narratives, paragraph structures</td>
<td>connected discourse, general interest topics, straightforward discourse</td>
<td>main idea of narratives, real-world topics, concrete texts</td>
</tr>
<tr>
<td>Superior</td>
<td>accuracy and fluency, abstract elaboration, extended discourse</td>
<td>research texts, complex topics, extended narrative</td>
<td>extended discourse, less familiar topics, specialized narrative</td>
<td>broad range of texts, wide range of subjects, stylistic awareness</td>
</tr>
<tr>
<td>Distinguished</td>
<td>articulate users, wide range of concepts, sophisticated discourse</td>
<td>full formal writing, wide range of topics, sophisticated discourse</td>
<td>rich cultural discourse, wide range of topics, sophisticated discourse</td>
<td>wide range of genres, complex topics, sophisticated discourse</td>
</tr>
</tbody>
</table>
Designing Successful Fluency & Accuracy Activities

• **Characteristics of Successful Fluency Activities:**
  1. Comprehensible input (reading and/or listening texts)
  2. Culturally authentic and personalized information gap:
     a. Genuine (students share authentic information, e.g. their own life experiences)
     b. Contrived (students share information assigned to them, e.g. roleplaying someone else’s experiences)
  3. Strategy Instruction
  4. Targeted language functions (e.g. narration, persuasion), text types, modes of language use (e.g. interpretive, interpersonal, presentational)
  5. Accountability phase (demonstration of mastery of skills, concepts, or information via multiple formats, e.g. oral presentation, written report, charts, graphs, digital storytelling)

• **Key Accuracy Components:**
  • Grammatical/Syntactical
  • Pronunciation/Intonation/Spelling
  • Lexicon
  • Sociolinguistic

A Five-Phase Lesson Plan

• Overview
  • Statement of goals, learning objectives

• Preparation
  • Presentation of listening, reading texts
  • Language processing tasks
  • Cultural context and background
  • Discussion of learning, language processing strategies

• Drill and Practice
  • Opportunities for discourse, spoken or written, interpersonal or presentational
  • Drill: teacher-centered
  • Practice: learner-centered

• Check
  • Demonstration of mastery of skills, concepts

• Follow-up
  • Discussion of outcomes, current and future strategies
  • Larger cultural comparisons, analysis
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Part 2: The Assessment Challenge
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>
</tr>
</thead>
</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 |

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               | 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>Teacher</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>1</td>
<td>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>
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
## Traditional Rubric Design

<table>
<thead>
<tr>
<th></th>
<th>Advanced</th>
<th>Proficient</th>
<th>Basic</th>
<th>Below Basic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic</strong></td>
<td>Topic is clear</td>
<td>Topic is generally clear</td>
<td>Topic is vague</td>
<td>Topic is unclear</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Demonstrates focus on topic</td>
<td>Minor lapses in focus on topic</td>
<td>Major lapses in focus on topic</td>
<td>Fails to demonstrate focus on topic</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>Proficient</td>
<td>Basic</td>
<td>Below Basic</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------</td>
<td>---------------------------</td>
<td>----------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Pretty noises</td>
<td>Has multiple pretty noises</td>
<td>Has only one pretty noise</td>
<td>No pretty noises</td>
<td>Bad, bad, ugly noises</td>
</tr>
<tr>
<td>Photos</td>
<td>Lots of colorful photos</td>
<td>One colorful photo</td>
<td>No colorful photos</td>
<td>Ugly, drab photos</td>
</tr>
<tr>
<td>(Oh yeah, we’ll get to why they created this - eventually…)</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
### Example: A Rubric for Concept Maps (Shuman et al., 2004)

<table>
<thead>
<tr>
<th>Comprehensiveness – covering completely/broadly</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>The map lacks subject definition; the knowledge is very simple and/or limited. Limited breadth of concepts (i.e. minimal 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>The map has adequate subject definition but knowledge is limited in some areas (i.e., much of the coursework is mentioned but one or two of the main aspects are missing). Map suggests a somewhat narrow understanding of the subject matter.</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>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organization – to arrange by systematic planning and united effort</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The map is arranged with concepts only linearly connected. There are few (or no) connections within/between the branches. Concepts are not well integrated.</td>
<td>The map has adequate organization with some within/between branch connections. Some, but not complete, integration of branches is apparent. A few feedback loops may exist.</td>
<td>The map is well organized with concept integration and the use of feedback loops. Sophisticated branch structure and connectivity.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correctness - conforming to or agreeing with fact, logic, or known truth</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The map is naïve and contains misconceptions about the subject area; inappropriate words or terms are used. The map documents an inaccurate understanding of certain subject matter.</td>
<td>The map has few subject matter inaccuracies; most links are correct. There may be a few spelling and grammatical errors.</td>
<td>The map integrates concepts properly and reflects an accurate understanding of subject matter meaning little or no misconceptions, spelling/grammatical errors.</td>
<td></td>
</tr>
</tbody>
</table>

### Example: A Rubric for Sociology Online Discussion (Evans, 2010)

<table>
<thead>
<tr>
<th></th>
<th>4 Points</th>
<th>2 Points</th>
<th>0 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></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><strong>Accuracy</strong></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><strong>Use of material</strong></td>
<td>You use and cite sources, including the text and articles and/or bring in an outside source, all of which clearly add significantly 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><strong>Sociological Analysis</strong></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>
</tbody>
</table>

### 2 Points

<table>
<thead>
<tr>
<th></th>
<th>1 Point</th>
<th>0 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></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>
</tr>
<tr>
<td><strong>Participation</strong></td>
<td>You write at least three or more substantive comments (using the above criteria) based on the discussion assigned.</td>
<td></td>
</tr>
<tr>
<td><strong>Time of Posting</strong></td>
<td>Your posts are spread widely during the discussion.</td>
<td>You post at two significantly different times.</td>
</tr>
<tr>
<td><strong>Posts Read</strong></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>
</tr>
<tr>
<td><strong>Clarity</strong></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>
</tr>
</tbody>
</table>
Writing Assignment:

Are there a clear topic?

Yes, the topic is clear.

Are there some supporting details written in a sequence that makes sense?

Yes, some interesting sentences that could be developed into paper with clear topic. No go to 1

No, topic is vague or unclear.

No focus is established.

Yes, the details support the topic and are well developed. The order of details makes sense. No, go to 3

Yes. Some details support topic, but it is confusing. Reader cannot figure out order of details. No go to 2

Developed by Vickie Hedrick

Hedrick, V. Continuous Improvement in the Language Arts Classroom. Quality Press (2010)
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
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)
    - ConcepTest (~1-2 minutes)

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

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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
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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
According to the flow model, experiencing flow is defined as the balance of challenges and skills. Adapted from Csikszentmihaly (1975/2000), the original model of the flow state includes three regions: boredom, flow, and anxiety. The flow region is characterized by a balance between perceived challenge and skills, where both are above the actor's average levels. In contrast, boredom occurs when skills are below average and challenges are above average. Anxiety is experienced when skills are above average and challenges are below average.

The Milan group subsequently showed that the resolution of this phenomenological map is not limited to four quadrants but rather involves more than four states. Delle Fave and Massimini (1988) utilized a four-dimensional model, where the challenge/skill formula (e.g., Hektner & Csikszentmihalyi, 1996) was operationalized as a disposition. Operationally, they divided the challenge/skill channel into five rings rather than four quadrants (see Figure 7.1b). The quality of experience intensifies as the individual navigates across the concentric rings, theoretically resulting in a more complex state of consciousness.

Recent Directions in Flow Research

The experience of flow is often associated with intrinsic motivation, where the activity itself is the reward. Flow is experienced when perceived challenges and skills exist, based on the balance of challenges (or opportunities) and/or skills. Flow is experienced more when both are perceived as high or low (Csikszentmihalyi & Larson, 1987). A quasi-random schedule with data collection for one week has been widely used to measure the flow state in specific contexts, in addition to other activities such as work, TV viewing, and leisure.

Contents of motivational states, providing a tool for building both therapeutic and functional environments, have been used to optimize the flow experience. Delle Fave and Massimini (1988) utilized a tool called the Experience Sampling Method (ESM) to assess differences across activity contexts in the experience of flow. The ESM studies of flow have focused on the sampling period with paging devices (pagers, programmable devices). Subjects are equipped with paging devices (pagers, programmable devices) and, at preprogrammed times, are asked to complete a questionnaire describing the moment at which they were paged. The method takes samples from the beginning focused on sampling not only activities but also cognitive, emotional, and motivational states, providing a tool for building therapeutic practice (Parks, 1996).

The ESM has been used as a repeated measure to examine the flow state within the resolution of this phenomenological map, resulting in more than four states. That is, flow is expected to occur as challenges increasingly exceed capacities for action. This mapping was based on the original activities and skills identified three regions of experience (e.g., "I get direct involvement," "I get direct interaction," and "I get involved"). The latter usually is measured by asking a person whether the situation is in reality a much more complex state of consciousness. The study of flow has progressed in large part because researchers in the late 1970s developed a tool for building therapeutic practice (Parks, 1996). More recently, researchers have developed tools such as the Jackson PRF (Personality Research Form) and Whalen (1993). They defined autotelic personality as the conjunction of receptive and active skills. Autotelic personality is the “I am doing it because of the experiential rewards” aspect of the metaskills that contribute to getting into flow and staying there (Csikszentmihalyi & Nakamura, 1989; Csikszentmihalyi et al., 1993). They theorized that jointly these qualities, one measured by the Jackson PRF and the other by Achievement and Endurance (Jackson, 1990), would account for autotelic individuals' openness to new challenges and readiness to engage them. This shift led to an important redefinition of the disposition as an autotelic personality. That is, flow is expected to occur when perceived challenges and skills are above the actor's average levels; when challenges and skills are adequate to engage them. This shift led to the resolution of this phenomenological map, resulting in a more complex state of consciousness. As Massimini and his colleagues showed, the mapping was based on the original activities and achieved an important redefinition of the disposition as an autotelic personality. That is, flow is expected to occur when perceived challenges and skills are above the actor's average levels; when challenges and skills are adequate to engage them.

The first mapping of the phenomenological terrain, reasonably consistent with this mapping, however, is a much more complex state of consciousness. Simply placing flow at the center of a four-dimensional space is insufficient to capture the complexity of the experience. As Massimini and his colleagues showed, the mapping was based on the original activities and achieved an important redefinition of the disposition as an autotelic personality. That is, flow is expected to occur when perceived challenges and skills are above the actor's average levels; when challenges and skills are adequate to engage them. This shift led to an important redefinition of the disposition as an autotelic personality. That is, flow is expected to occur when perceived challenges and skills are above the actor's average levels; when challenges and skills are adequate to engage them. This shift led to an important redefinition of the disposition as an autotelic personality. That is, flow is expected to occur when perceived challenges and skills are above the actor's average levels; when challenges and skills are adequate to engage them.
Fig. 2. Estimates by 160 gynecologists of the probability that a woman has breast cancer given a positive mammogram, before and after receiving training in how to translate conditional probabilities into natural frequencies.
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