University of Nebraska Medical Center (UNMC)
University of Nebraska at Omaha (UNO)
Breaththrough Thinking Conference
2018

Roberta B. Ness, MD, MPH
James W. Rockwell Professor in Public Health
University of Texas School of Public Health

Innovation Defined

Surprise in the service of health and prosperity

- Make existing resources better, faster, cheaper
- Create new technologies, breakthroughs
CREATIVITY IN AMERICA

THE SCIENCE OF INNOVATION AND HOW TO REIGNITE OUR IMAGINATIONS
BY PD BRONSON & ASHLEY MERRYMAN

RISING ABOVE THE GATHERING STORM, REVISITED
Rapidly Approaching Category 5
Teaching Innovation

Can innovation be taught?

Does It Work?
Clapham et al: Meta-analysis of 40 studies
Scott et al: Meta-analysis of 70 studies

2 – 3X increases in fluency, novelty, and originality
Improvements in problem-solving, attitude and work performance
Does It Work?

Structured programs demonstrated effects independent of:
- Age
- Gender
- Intellectual capacity
- Professional/academic setting

Conceptual Components

- Recognizing and finding alternatives to habitual cognitive patterns
- Aligning divergent thinking with the scientific method
- Learning to use tools that enhance generative ideation
Overcoming Habitual Cognitive Patterns and Their Implications

Big "I" Innovation Means Thinking Outside Frames

- Frames define human communication and thus thinking
- Frames are expectations which we use to interpret new information and draw inferences
Little “i” Innovation
- Cell phone
- GPS
- Safety of Anesthesia

Big “I” Innovation
- Transistor
- Theory of special relativity
- Germ theory

Threats to Mankind Require
Big “I” Innovation
- Income/Education disparities
- Alzheimer’s disease
- Global warming
- Emerging infections
- Obesity
Example: Expectation in going to a restaurant

Gary and Nancy are lying on the floor dead. Around them is a puddle of water and some broken glass. What are the circumstances of their death?
Answer: They are fish and their fish tank broke – thus they suffocated.

Emotion

Remove street signs from city centers
Metaphors and Frames

- War on cancer
- Versus
- Cancer as neighbor

Tools that Enhance Idea Generation
Tool 1: Finding the Right Question

- Big questions
  Example: Jeremy Morris, father of physical activity: "What about social class alters CVD risk?"

Tool 2: Observation

- Normal observation becomes complacent
- Normal observation is biased by expectations
Tool 2: Observation

- Marshall and Warren win Nobel Prize for discovery of \textit{H. pylori}

Tool 3: Analogy

- Kekule: Structure of benzene as a snake seizing its own tail
- Bell: Electromagnetic vibration as human voice
- Jenner: Cowpox protection as smallpox protection
**Tool 5: Change Your Point of View**

- Darwin imagined himself as a plant
- Einstein imagined traveling at the speed of light
- Montessori imagined herself as a child

---

**Tool 6: Broadening Your Perspective**

- Ancel Keys: Father of the Mediterranean Diet
- Expanded his research network to create the first international comparisons of heart disease: Japan, Greece, Finland
Tool 6: Broadening Your Perspective

- How can we provide more nutritious foods in America’s lunchrooms?
- How do we get America to eat better?

Tool 7: Reversal

- Serendipity: a “happy accident”
- Alexander Fleming: father of antibiotics
- Joseph Goldberger: presence of infection vs. absence of nutrient as the cause of pellagra
Tool 7: Reversal

- Medicine: Presence of disease
- Public Health: Absence of disease

- Implications for obliviousness to absence
  - Hard to get people excited
  - Hard to get compliance

Tool 8: Reorganization and Rearrangement

- Functional fixedness: a particular object implies a particular use
- Candle experiment: attach the candle to the wall
  - Candle
  - Book of matches
  - Box of thumbtacks
Tool 8: Reorganization and Rearrangement

- Combining disciplines
- Nanoparticle engineers and pharmacologists to create new systems for drug delivery

Tool 8: Reorganization and Rearrangement

- How might you design a neonatal incubator for developing, resource-poor settings?
Tool 9: Brainstorming Group

DARPA: Red Balloons

Challenge: Ten 8 foot high, fixed bright red weather balloons at random locations around the U.S. $40,000 to the first person or team to find all 10 balloons.

Tool 9: Power of Groups

- "C" Factor
- Groups performance on wide range of intelligence tasks
- Not strongly correlated with individual intelligence
- Correlated with social sensitivity (e.g., inclusiveness) of group
Tool 9: Brainstorming Group

- Generates > 100 ideas/hour
- Divergent thinking first
- Convergent thinking next

Harmonizing

- Idea Generation and the Scientific Method

- Hypothesis ➔ Expectation
- Inference ➔ Observation
Stepwise Harmonization

- Define the problem
- Gather information
- Separate raw inputs from frames
- Generate alternative, original ideas
- Converge on most useful insights/hypothesis
- Develop action plan to test hypothesis

Thinking Inside the Box

Death: scary, sober, mysterious

Approach with awe, fear
Few people have advance directives
Thinking Outside the Box

- Death and taxes
  - Tax form for advanced directives

Summary

1. Innovative thinking can be taught
2. Key is thinking outside frames
3. Tools include:
   - Alternative framing and metaphors
   - Kenner observation
   - Awareness of cognitive biases
   - Analogy
   - Expansion
   - Reversal
   - PO
   - Etc