

Physicians as Leaders in Improving Health Care

Series Editors:

Donald M. Berwick, MD, MPP

Thomas W. Nolan, PhD

Innovative Thinking for the Improvement of Medical Systems

Paul Plsek, MS

If health care systems are not delivering the desired results, those systems must be changed in some way. Innovative thinking is sometimes needed to generate ideas for improvement. Many persons erroneously believe that innovative thinking is a special gift or that it requires an air of lightheartedness that seems inappropriate in a health care setting. Current research in the cognitive sciences has yielded methods to help individual persons and groups generate innovative ideas. These methods do not require any special gift and can be practiced in a serious way. Through a case example from a health maintenance organization, this paper shows that, given some direction, groups of health care professionals can produce useful and innovative ideas. The tools of idea generation are based on three principles: mental attention, escape, and movement. Activities that help persons pay attention to their current situations in a different way, escape their current mental patterns about the situation, and maintain movement in their thoughts support efforts to generate innovative, testable ideas for health system improvements. This paper illustrates several methods of stimulating innovative thinking and shows the ways in which they can be applied in health care.

For the author affiliation and current address, see end of text.

Ann Intern Med. 1999;131:438-444.

Previous articles in this series have established the need for change in health care systems. Nolan (1) noted that every system is perfectly designed to get the results that it gets. If we are not always happy with the results that our health care systems deliver, then we must change those systems in some way.

The need for change leads directly to the need for ideas for change. Berwick (2) pointed out that much is already known about changes that can improve health care, but this knowledge is not widely used. Clemmer and colleagues (3) and Berwick (2) described methods for bringing about collaborative agreement and for testing ideas for change once we have the ideas in hand.

In many situations, however, certainty and agreement about specific ideas for change are not as

common. These situations fall into a zone of complexity where innovation is needed (4-6). Simply stated, we need innovative thinking when we are faced with a clear imperative for change but a literature search, experience, and logical analysis have provided few effective ideas on which we can agree. In addition, even when good ideas for change exist, innovative thinking may be needed to adapt those ideas to a particular setting.

Like the reverse gear in an automobile transmission, innovation is something that we do not need all of the time or even most of the time. There is great value in conservative thinking in the practice of medicine, and constant novelty in organizational processes would be disorienting. However, innovative thinking can be useful and indeed essential in some situations.

Unfortunately, many believe that the ability to generate innovative ideas is a special gift that only certain persons possess. This is simply not true (7, 8). The purpose of this article is to show that although some persons may be naturally better at it than others, innovative thinking is a mental capacity that we all possess. Just as it is possible to put a car's transmission into reverse when necessary, it is possible to mentally "shift gears" and direct oneself to think in new ways for a period of time. I will describe concepts from the cognitive sciences that lead to tools for generating innovative ideas and demonstrate how physicians and office staff can use these tools to improve health care systems.

Illustrative Case Study: Applying Innovative Thinking in a Managed Care Clinic Setting

The senior administrator responsible for clinic operations in a large midwestern health maintenance organization (HealthPartners, Minneapolis, Minnesota) planned a series of 1.5-hour lunchtime seminars to engage busy clinicians and staff in innovative thinking about how clinics might be im-

proved. Although this organization has access to information about what other organizations are doing to improve care delivery, the leader's goal was to generate some fresh new ideas and to engage the staff directly in the thinking process.

Three sessions were conducted during a 1-week period. One clinic was a small primary care site; the other two clinics were larger sites that had primary care and specialty care clinics in a multistory building. Each session involved groups of approximately 15 persons, representing a cross-section of physicians, nurses, managers, and support staff. The participants were not preselected for creative abilities. The local clinic leader invited a mix of persons who were seen to have a generally positive attitude and who were able to spare the time from their work day.

The sessions began with a short presentation of some theory and methods for innovative thinking. The bulk of the session was devoted to idea generation and focused on the process of the generic clinic visit shown in **Figure 1**. Participants selected process steps for focus, quickly explored a few tools for idea generation, and broke up into smaller groups of two to four persons. In these groups, they used the tools to generate innovative ideas for improvement in the selected process steps. The small groups shared their ideas with the full group for further enhancement. With minimal training and under severe time constraints, the multidisciplinary groups at the clinics used various approaches to generate 74 innovative ideas.

Many of the ideas resulted from mental substitutions (for example, substituting the Internet for a telephone call to schedule an appointment or substituting a computer-based kiosk for the registration desk). Focusing the mind on something that is currently taken for granted and then mentally substituting other things is an easy but productive technique for innovative thinking.

Other ideas came from mental escape of "rules." For example, it seems to be a rule in most health care clinics that a nurse must record weight and blood pressure during the patient intake process. A deliberate escape of this tradition resulted in one group suggesting that, as part of a patient self-care program, the patient could perform these procedures by using readily available digital scales and blood pressure cuffs. Still other ideas were the result of progressive building on a central idea, as illustrated by the string of ideas shown in **Figure 2**.

The groups also used analogies to stimulate ideas. For example, focusing on how a fast-food restaurant chain delivers service led to a series of ideas for drive-through ancillary services (for example, prescription refills or delivery of laboratory samples). Similarly, a focus on banks resulted in one group's suggestion that the clinic could form a part-

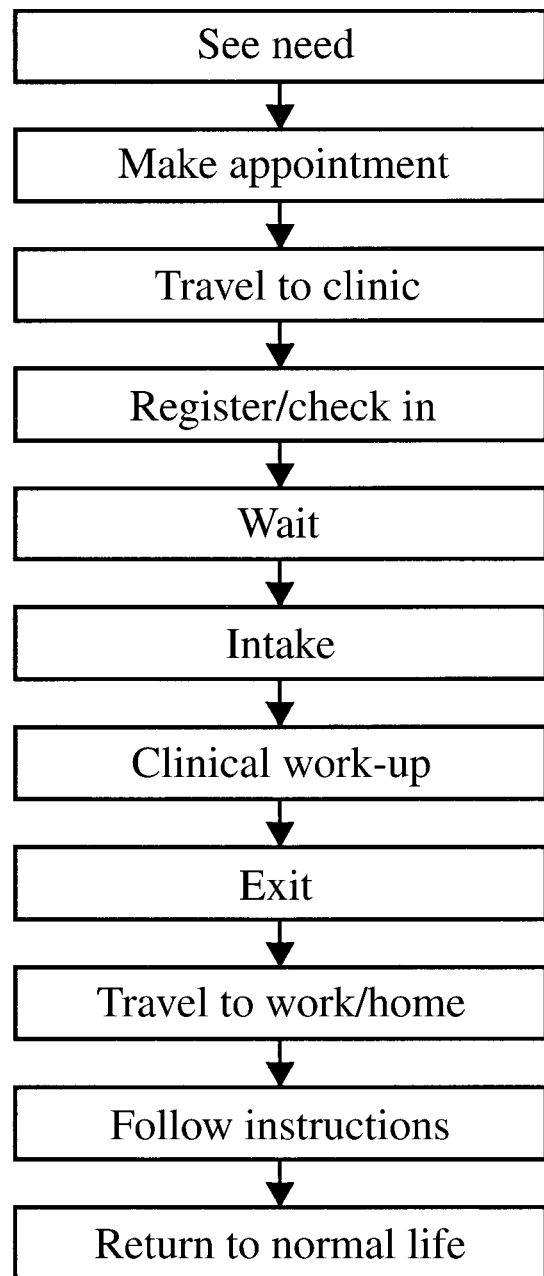


Figure 1. High-level flow chart of a typical visit to a clinic (from the patient's perspective).

nership with a bank to use its automated teller machines as a secure network for providing test results to patients at their convenience.

The use of simple tools to direct mental substitution, rule escape, idea building, and analogous thinking resulted in many innovative ideas worthy of testing as potential changes in the health care delivery system (2). It is important to note that typical clinical and support staff in a busy office setting generated these ideas. No special creative gift was needed. The groups did not use any of the games or visualization techniques that many persons erroneously believe are the only ways to stimulate innovative thinking.

Essential Theory Underlying Innovative Thinking

The experience in these sessions is not atypical. How does it work? Over the past 60 years, researchers in the cognitive sciences have begun to understand mental processes. Understanding the modern theory of mind helps us to be innovative in our thinking because it enables us to see what we are trying to accomplish when we use various techniques. Several good overviews of the work in this field are available (8–11).

Creativity Defined

In reviewing definitions of creativity in the literature (10, 12), we see underlying themes that make up what we usually mean when we say “creativity.” *Creativity* is the connecting and rearranging of knowledge in the minds of persons who allow themselves to think flexibly to generate new, often surprising ideas that other persons consider useful.

The development of glues to replace stitches for closing surgical incisions illustrates this definition. Using adhesive to close an incision is a new and useful idea. You may have smiled or expressed pleasant surprise when you first heard it. In hind-

sight, however, we can see that this idea is nothing more than a novel connection of existing knowledge—adhesive as a way of holding things together and the need to repair the skin after surgery. It makes perfect sense now that we hear it, but coming up with the idea required the mental flexibility and courage to step out of the current paradigm of the way in which surgical incisions should be closed.

The idea of connecting and rearranging knowledge has much in common with the literature on reflective or experiential learning and the more recent literature on the learning organization (13, 14). The key distinction in innovative thinking is the wide-ranging nature of the mental search. In practice, reflective learners often learn more about things that they already know something about (depth of knowledge). Innovative thinkers use many of the same skills but apply them to breadth of knowledge. The reflective learner often digs deeper; the innovative thinker, in contrast, often ranges wider. Of course, both ways of thinking can be productive.

The notion of surprise in the definition of creativity suggests that when we feel ourselves laughing at an idea, we should pause on the thought and work with it; it could contain the germ of an inno-

<i>Central idea generated by creative substitution...</i>	Replace the registration desk with a touch-screen kiosk. The screen displays patients we are expecting; the patient touches his or her name on screen, verifies information, and gets directions. We would probably still need a small registration desk for walk-in patients or for things not easily covered on screen, but 80% or more of visits could be handled through the kiosk.
<i>Building on the above idea...</i>	Screens and instructions could be in various languages that the patient selects.
<i>Further idea...</i>	The patient swipes a magnetic-strip membership card at the door to let us know that he or she is here. Computer looks up appointment and gives directions.
<i>Idea...</i>	If the card was a debit card, it could automatically deduct the copayment.
<i>Idea...</i>	As an inducement to use the debit card and save labor, after every 10 copayments made by debit card, 1 copayment would be free.
<i>Idea...</i>	Whether we use a card or touch screen, the computer should send a signal to the clinic staff, alerting them that the patient is coming. We could then begin the process even before the patient arrives, reducing waiting. We could also greet the patient by name because we now know that he or she is coming.

Figure 2. Ideas generated by building on a central idea.

vative concept. In contrast, the usual reaction in organizations when someone expresses a laughable idea is to dismiss it quickly and get on with “serious business.” Practically speaking, pausing on a laughable thought may be one of the most productive things we can do when seeking innovation. For example, the suggestion that we look at banks for analogies that may help improve service in a medical clinic is, at first, laughable. However, by working with that suggestion, the group in the case study came up with several innovative ideas for ways to use the network of secure automated teller machines.

Mental Processes

To direct our minds toward innovative thinking, we must first understand how the mind operates in day-to-day thinking. Research shows that our processes of perception filter out most of what goes on around us and focus our attention toward signals in the environment that fit existing memory patterns of how things should be (15). We do not even need the whole pattern or a perfect match; our mind is flexible enough to provide an explanation for the world with all its variety. This flexible pattern-matching mechanism gives us many abilities that we take for granted. For example, it enables a clinician to make a preliminary diagnostic judgment based on an initial review of the pattern of a patient’s symptoms.

Although this pattern-matching system is useful for most tasks of daily life, it is clearly not optimal when we want innovative ideas. The ideas of drive-through delivery of laboratory samples and a kiosk for patient intake do not fit our existing mental patterns of how a clinic should function. Innovative thinking, therefore, requires that we think in a new direction, away from or beyond our current mental patterns toward some new pattern.

Heuristic Principles and Tools for Innovation

Research indicates that experts in a given area do more effective thinking primarily because they have better knowledge of heuristic principles than novices do (16, 17). *Heuristic principles* are general principles that provide productive direction for thought and action without specifying an exact method or solution. **Table 1** provides a short list of heuristic principles for innovative thinking based on common themes found in the innovation literature (10). Several books (10, 18–26) contain more than 250 tools that can help us overcome the limitations of past mental patterns and implement the general advice given by these heuristic principles.

Three Basic Principles for Innovative Idea Generation

Although many tools are available for idea generation, all are based on three simple principles: at-

Table 1. Basic Heuristic Principles for Innovative Thinking

Make it a habit to purposefully pause and notice things.
Focus your creative energies on just a few topic areas that you genuinely care about, and work on these areas purposefully for several weeks or months.
Avoid being too narrow in the way you define your problem or topic area; try to use broader definitions, and see what insights you gain.
Try to come up with original and useful ideas by making novel associations among things that you already know.
When you need creative ideas, remember: attention, escape, and movement.
Pause and carefully examine ideas that make you laugh the first time you hear them.
Recognize that your streams of thought and patterns of judgment are not inherently right or wrong; they are just what you think now, based primarily on patterns from your past.
Make a deliberate effort to harvest, develop, and implement at least a few of the ideas you generate.

attention, escape, and movement (10). Anything that helps us pay attention in a different way, escape our current mental patterns, and maintain movement in our thoughts will support our efforts at innovation.

To illustrate these three basic principles, we will consider a team in a primary care clinic that is working to improve the subprocesses involving the flow of consulting information from specialists to primary care physicians. Innovative thinking about this problem could begin by recognizing the fact that we usually consider it the responsibility of the specialist’s office to type consultation notes and send them to the primary care office. We could escape this paradigm by asking, “What if a law was passed making it illegal for specialist’s offices to do word processing?” If we turn off the mental processes of judgment that cause us to reject this question out of hand, we can then proceed to creative movement in our thinking. For example, if such a law was passed, we could provide a voice mailbox in the primary care physician’s office in which specialists could dictate consultation notes immediately after the encounter with the patient. The primary care office staff could type these consultation notes, keep a copy for the primary care physician’s records, and send a copy to the specialist. In this way, the primary care physician would have immediate access to the results of the specialist consultation. This innovative idea could be tested on a small scale with a few willing colleagues to see whether it improves the system of information flow among primary care physicians and specialists.

Rethinking Medical Office Practice

Table 2 describes several tools that are particularly helpful in efforts to rethink systems of work. Each tool provides mental direction for idea generation based on the principles of attention, escape, and movement.

Table 2. Tools for Stimulating Innovative Thinking

Tool	Synopsis
Escape the obvious	List assumptions, rules, traditions, or aspects of the current situation that are taken for granted. Temporarily escape these and use free association to generate novel ideas.
Provocation ("po")	Make an outrageous or nonsensical statement, but then use mental movement to seriously examine the "what-if" implications of the statement. The word "po" can be used to signal that the statement is meant to be taken as a creative provocation (for example, "Po, it is illegal for specialists' offices to do word processing").
Concept fan	Begin with a high-level flow chart of a current process. Identify the concepts that underlie each step on the flow chart (some steps may have multiple concepts). Generate alternate ways to achieve each of these concepts. List these next to each concept.
Morphologic analysis	Construct multiple creative scenarios by combining several ideas from previously generated lists (for example, lists from a concept fan). You can do this purposefully or by selecting ideas at random and forcing a coherent connection.
Analogies	Adapt concepts, approaches, and ideas from another setting into your context. You can identify an analogy by directly searching for an analogous situation or by randomly selecting a setting and forcing yourself to see some analogy.

Escape-the-Obvious and Provocation Tools

The escape-the-obvious tool focuses our attention on assumptions, rules, traditions, and aspects of medical office practice that are taken for granted. We have already seen examples of this technique used to escape tradition in the processes of appointment making, patient intake, and flow of information from specialists. Health care systems have many traditions and rules. Improvement efforts are often directed at systems in which our expectations based on these rules are not being met. For example, we could pursue changes that would decrease appointment "no shows" or improve the percentage of patients seen in a primary care practice for which complete consultant notes are included in the medical record. These system improvements are worthwhile; however, it may also be worthwhile to deliberately escape the notion that we must even have such processes. No-appointment-necessary systems and voice mailboxes for consultant dictation can be the results of mental movement and may constitute new solutions to these old problems. The innovative-thinking approach is similar to backing up and driving around an obstacle rather than trying to drive through it.

A process flow chart similar to the one shown in **Figure 1** is a good place to start in identifying rules, assumptions, traditions, and aspects of medical office practice that are taken for granted. A physician-leader could display such a flow chart at a retreat

for office staff and call for input to construct a list of "rules" associated with each step. Of course, some assumptions and rules are there for good purpose and constitute ethical and legal constraints that we must not violate. Usually, however, there is a sense of mild amazement at how many arbitrary assumptions and rules we have imposed on ourselves as a simple matter of tradition. We can use good judgment, whether working in a group or alone, to determine which rules to mentally escape. The point is to choose a few rules and practice mental movement in search of an innovative approach. After free-flowing idea generation, we can test the ideas on a small scale to ensure that they are effective and have no unintended consequences (1, 2).

We can derive provocation for mental escape in several ways. We could suggest that the government has passed a law against the traditional rule (for example, "It is now illegal for a physician to give final instructions to a patient face-to-face"). Another approach could be to ask persons to imagine that the opposite of the rule is true (for example, "Imagine that the patients have to take care of the nurses"). There is no right or wrong way to do it; the point is to gain mental attention and provide temporary escape from some aspect of the current system that is taken for granted.

The next step is mental movement. The provocation "It is now illegal for a physician to give final instructions to a patient face-to-face" causes us to think about ways of getting the information to patients without the physician physically present. For example, perhaps a nurse could give the instructions. This method could work in routine situations for which we have a clear protocol. Even if we continue to have the physician actually give the instructions, clear protocols that are shared with the nurses could decrease telephone messages. This could make the office run more smoothly.

Another idea would be to substitute a tape recording of the physician's instructions. For practical implementation of this idea, an inexpensive tape recorder could be kept in the examination room. When the physician begins the instructions, he or she turns on the tape recorder, records the conversation, and hands the tape to the patient; the patient can play the tape later if questions arise after the visit. It would be easy to test this idea with a small group of willing patients (for example, elderly patients may find this idea appealing and appropriate).

The escape provocation does not need to be taken literally. In discussing the involvement of nurses, we removed the physician from the process, but in discussing the possible use of a tape recorder, mental movement brought us to an idea that enhanced the process without eliminating the physi-

cian. The point is simply to move mentally and collect ideas for later consideration.

The ideas that were generated lend themselves to testing. Through multiple tests, the ideas could evolve or be phased out over time, similar to the way in which suitable features evolve in species in nature. Such guided evolution is a useful approach for bringing about innovation in complex adaptive systems (6, 27). Implementation of new ideas is a social and technical process. Small tests of change can help reduce resistance and risks (2).

Concept Fans and Morphologic Analysis

Figure 3 illustrates a portion of a concept fan, a creative thinking tool that is particularly well suited for innovative redesign of systems (19, 28). We begin with a high-level flow chart of the current process and extract the underlying concepts of each step by asking, "What is the basic purpose of this step in the process?" These underlying process concepts provide the attention points for innovative thinking. We then capture our current approach and use mental escape and movement to list innovative alternatives. For example, we could ask, "In what other ways could we bring the patient and provider together?"

A natural next step is *morphologic analysis*, the

process of building innovation scenarios by combining multiple ideas from a long list (29). We select ideas deliberately or at random and try to connect them into a coherent process. For example, by using the concept fan from Figure 3, the following innovation scenario could be tested.

During a trial arrangement, patients at a large company could e-mail their physician's office to indicate their need for an appointment. After enough requests, the physician would schedule a trip to the workplace, where arrangements would be made for appropriate space. The employer would not mind providing the space because the arrangement would reduce work time that is lost because of physician appointments. At the workplace, the physician's staff would use the internal telephone system to "pull" patients into the clinic with minimal waiting; that is, patients would be called approximately 5 minutes before the physician was ready for them, and they would begin heading down.

Conclusion

The capacity for innovative thinking is common; a little bit of mental direction is often all that is needed. Serious persons working on serious issues can practice innovative thinking in a serious way.

Current Process (High Level)	Concepts	Alternative Means
Appointment	Scheduling provider and patient time	<ul style="list-style-type: none"> - by telephone (<i>current method</i>) - by fax - by modem and computer - no schedule, just walk in - provider's calendar controls the date and time (<i>current method</i>) - patient's calendar controls the date and time - provider contacts the patient to schedule - clinic visit done in conjunction with some other patient activity
Patient Arrival	Bringing the patient and provider together	<ul style="list-style-type: none"> - patient comes to clinic (<i>current method</i>) - provider makes house call - provider goes to patient's workplace - provider dispenses traveling service in a van - communicate by medical telemetry equipment - by telephone (<i>sometimes used as current method</i>) - by videophone - patient consults an algorithm given to him or her by physician - e-mail questions and answers - patient's family members visit provider and relay information - satellite dish connection - mail questions and answers - provider on an interactive CD-ROM
Check-in	Recognizing the patient's presence	<ul style="list-style-type: none"> - patient gives name at reception desk (<i>current method</i>) - patient wears name tag, and we just notice - patient presents a membership card when he or she enters - cross-referencing patient's existing credit card - use a card reader/scanner at parking lot entrance - patient calls ahead and says "I'm coming" - we call the patient and say "We're ready for you" ("pull system") - patient's car has a radio transmitter that alerts us to his or her arrival - patient touches name on touch screen - display patient's name over a room when patient walks in, motion detector senses him or her

Figure 3. Beginnings of a concept fan for the process of patient intake in a clinical office.

The three simple principles of innovative thinking—mental attention, escape, and movement—provide a powerful, scientifically based construct to guide idea generation.

Physicians can lead improvements in systems by helping to institute both analytical and innovative-thinking methods within collaborative work groups. If leaders listen to good ideas, encourage prudent risk-taking, support small-scale tests of change, and model experiential learning, fundamental change in health care will be possible. We do not need to look far beyond the boundaries of our own organizations for idea generation. Physicians and office staffs have the mental capability to imagine new systems of work that make care more accessible, more satisfying, and more effective for the patients they serve.

From Paul E. Plsek & Associates, Inc., Roswell, Georgia.

Acknowledgments: The author thanks the staff at HealthPartners, Minneapolis, Minnesota, who participated in the workshops. He also thanks colleagues at the Institute for Healthcare Improvement in Boston, Massachusetts, for encouragement and suggestions.

Requests for Reprints: Paul Plsek, MS, Paul E. Plsek & Associates, Inc., 1005 Allenbrook Lane, Roswell, GA 30075.

References

1. Nolan TW. Understanding medical systems. *Ann Intern Med.* 1998;128:293-8.
2. Berwick DM. Developing and testing changes in delivery of care. *Ann Intern Med.* 1998;128:651-6.
3. Clemmer TP, Spuhler VJ, Berwick DM, Nolan TW. Cooperation: the foundation of improvement. *Ann Intern Med.* 1998;128(12 Pt 1):1004-9.
4. Stacey RD. *Strategic Management and Organizational Dynamics.* London: Pitman; 1996.
5. Stacey RD. *Complexity and Creativity in Organizations.* San Francisco: Berrett-Koehler; 1996.
6. Zimmerman BJ, Lindberg C, Plsek PE. *Edgework: Complexity Resources for Healthcare Leaders.* Dallas: VHA; 1998.
7. Weisberg RW. *Creativity: Beyond the Myth of Genius.* New York: WH Freeman; 1993.
8. Sternberg RJ, ed. *The Nature of Creativity.* Cambridge, England: Cambridge Univ Pr; 1988.
9. Runco MA. *Creativity Research Handbook: Perspectives on Creativity.* New York: Hampton Pr; 1997.
10. Plsek PE. *Creativity, Innovation, and Quality.* Milwaukee, WI: ASQ Quality Pr; 1997.
11. Plsek PE. Directed creativity. *Quality Management in Health Care.* 1994;2(3): 62-76.
12. Taylor CW. Various approaches to and definitions of creativity. In: Sternberg RJ, ed. *The Nature of Creativity.* Cambridge, England: Cambridge Univ Pr; 1988.
13. Kolb DA. *Experiential Learning. Experience as the Source of Learning and Development.* Englewood Cliffs, NJ: Prentice Hall; 1984.
14. Senge PM. *The Fifth Discipline: The Art and Practice of the Learning Organization.* New York: Doubleday; 1990.
15. Potter MC. Remembering. In: Osherson DN, Smith EE, eds. *An Invitation to Cognitive Science: Thinking.* v 3. Cambridge, MA: MIT Pr; 1990.
16. Polya G. *How to Solve It: A New Aspect of Mathematical Method.* 2d ed. Princeton, NJ: Princeton Univ Pr; 1957.
17. De Groot AD. *Thought and Choice in Chess.* The Hague: Mouton; 1965.
18. Black RA. *Broken Crayons: Break Your Crayons and Draw Outside the Lines.* Dubuque, IA: Kendall-Hunt; 1995.
19. de Bono E. *Serious Creativity.* New York: HarperCollins; 1992.
20. Higgins JM. *101 Creative Problem Solving Techniques.* Winter Park, FL: New Management; 1994.
21. Koberg D, Bagnall J. *The All New Universal Traveler: A Soft Systems Guide to Creativity, Problem-Solving, and the Process of Reaching Goals.* Los Altos, CA: William Kaufman; 1972.
22. McGartland G. *Thunderbolt Thinking.* Austin, TX: Bernard-Davis; 1994.
23. Michalko M. *Thinkertoys: A Handbook for Business Creativity for the 90s.* Berkeley, CA: Ten Speed Pr; 1991.
24. VanGundy AB. *Idea Power.* New York: AMACOM Books; 1992.
25. von Oech R. *A Whack on the Side of the Head.* New York: Warner; 1983.
26. von Oech R. *A Kick in the Seat of the Pants.* New York: Harper Collins; 1986.
27. Kauffman S. *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity.* New York: Oxford Univ Pr; 1995.
28. Plsek PE. Bringing creativity to reengineering efforts. In: Lenz P, ed. *Reengineering Health Care: A Practical Guide.* Tampa, FL: American Coll of Physician Executives; 1998.
29. Zwicky F. *Discovery, Invention, and Research through the Morphological Approach.* New York: MacMillan; 1966.