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Issues Involving Practice-Based Learning and Improvement

Systems Thinking: A New Lens for Old Problems

Laura L. Bierema, EdD

Abstract

This article introduces systems thinking and identifies its implications for practice-based learning and improvement. The article defines systems, identifies fundamental aspects of systems thinking, and provides strategies for creating more practice-based learning environments in medical contexts.

Key Words: Continuing, continuing professional development, improvement, medical education, organizational systems, practice-based learning, social context

Imagine that your medical organization is an ocean liner and you are "the leader." What is your role?[1] Whereas many important roles, such as engineer, captain, and navigator, come to mind, the role of the ship's designer is generally overlooked.[1] Yet a designer has more influence than anyone over the end product, whether it is a ship or a medical practice. Designers matter because organizations behave based on how they are *designed*. The visible and invisible architecture of an organization influences how people, policies, and paperwork move through them. Thus, the task of designing organizations systemically in a fashion that improves learning and effectiveness is an important competency in any organization. Poorly designed organizations are very difficult to lead or change.

The success of the modern age is attributable in large part to our ability to design mechanical, fragmented organizations to complete tasks. Sometimes these organizations work efficiently, but too often their fragmented nature causes duplication of effort, increased errors, and poor resource use. For instance, the United States spends more on health care than any other nation in the world, yet over 40 million people have no health care coverage. Further, the United States ranks thirty-seventh among the world's health systems, behind Morocco, Chile, and Cyprus,[2] and lags behind other developed nations in mortality. This severe breakdown of the medical system is attributable in part to reductionist thinking that ignores systems dynamics. In other words, the system is poorly designed.

Mechanical (or reductionist) thinking is behind the rise of the assembly line, bureaucracy, and modern-day medicine. Reductionism is also behind the rise of medical specialties and the placement of undue value on disease-oriented outcomes. For instance, the effect of reductionist thinking is evident in both research and clinical practices, in which the focus on whether drugs improve a number takes precedence over whether they improve patient outcomes.

Go to your doctor and she or he will wade through stacks of paper charts with incomplete records in multiple places. The U.S. medical system is replete with duplication of services, poor information management, and little vertical or horizontal integration of services. Answering simple questions such as "What are your current medications?" "What are your hemoglobin A_{1c} results for the past 2 years?" and "What was the result of your last mammogram?' can be a daunting and time-consuming task owing to the lack of systems.

Dr. Bierema: The University of Georgia, Athens, Georgia.

Reprint requests: Laura L. Bierema, EdD, Assistant Professor of Adult Education, Department of Adult Education, University of Georgia, 4th Floor, River's Crossing, Athens, Georgia 30602.

Although we live in an era of information, organizations cling to systems with which they have come to feel comfortable, even ignoring good information if it contradicts past practice and experience. Patients have become comfortable with poor systems as well. Strangely enough, an automotive dealer can instantly tap into a database and give you a better health history on your car than your family practitioner can about your own health.

For too long, we have allowed medicine to be practiced as an art, with too much value placed on individual clinical expertise and not enough on systems creation to help people make better decisions. Yet these newer designs and models for better medical systems such as practice guidelines and evidence-based medicine have met with resistance. Such resistance to change is not unique to medicine. Airline pilots resisted "practice guidelines" when they were first introduced 60 years ago. Today, few of us would knowingly put our safety into the hands of a pilot who was "practicing the art of flying" instead of systematically using checklists and other "practice guidelines," yet we do it regularly with our health.

This article introduces systems thinking and identifies its implications for practice-based learning and improvement. The article defines systems, identifies fundamental aspects of system thinking, and provides strategies for creating more practice-based learning environments in medical contexts.

Defining a "System"

A system is a whole consisting of two or more parts whose elements continually affect each other over time as they operate toward a common purpose. Examples of systems include biologic organisms, the atmosphere, diseases, ecologic niches, factories, communities, political entities, families, teams, organizations, and chemical reactions, among others.

A system would cease to exist if the whole was divided into parts. For example, in the human body, each part affects the behavior of the whole (e.g., heart), and each part's effect depends on what the other parts are doing (e.g., heart and lungs). If you subdivide the body into parts, properties of the parts will remain, but not the whole, because a system is created by the interaction of the parts. For instance, a body lives, breathes, and moves, just as a motor vehicle transports you from one place to another. Neither body parts nor car parts can walk or drive on their own, but their parts combine to provide their unique functions. Systems cannot be understood through fragmented analysis because once you dismantle a system, it loses its essential properties. That is why attempts to fix part of a system often fail to fix the system as a whole.

Systems Thinking in Action

We have been well trained in reductionist thinking. To shift to systems thinking, it is important to understand how systems thinkers learn, think, and act. A systems perspective has been advocated in making reforms to health care.[3,4] This section addresses these practical matters of systems thinking. Systems thinkers recognize that seeking organizational control is futile. Instead, they aim for prediction based on patterns and behaviors over time, recognize that natural systems are self-organizing, and understand that order evolves from disorderly, chaotic processes, such as learning. Harnessing workplace learning or becoming a "learning organization" has been suggested as an answer to shifting from the machine age to the systems age mentality. Essentially, making this shift calls for new models of structuring organizations and leading them.

Learning in Systems

Systems thinking requires new learning and thinking that begins at the individual level and ideally spreads throughout the organization. The quality of individual learning impacts systems functioning, yet learning is riddled with errors that prevent systems thinking. Argyris argues that most people

do not know how to learn and that even those who are regarded as the "smartest" are often not very effective learners.[5] Although the assertion that few of us are good learners should be cause for alarm, most individuals and organizations are not even aware that they have learning deficiencies.

One reason learning is deficient is that organizations tend to define learning too narrowly as "problem solving." This could also be said of medicine that is disease oriented rather than patient oriented. Problem solving usually focuses on error correction in the external environment by professionals unaccustomed to failure. For example, encainide and flecainide are powerful drugs that were enthusiastically adopted during the 1980s to suppress abnormal heart rhythms in patients who had suffered an acute myocardial infarction. They were adopted based solely on mechanistic data regarding their effect on heart rhythms and without any data on the effect on the entire "patient system." Unfortunately, it is estimated that 50,000 Americans died because this drug had unexpected systemic effects on the heart's ability to function that caused premature death.[6]

Argyris suggests that professionals' greatest fears are of failing and making mistakes; thus, they create elaborate mechanisms to defend themselves against either outcome at the expense of the system. For instance, physicians are expected to consistently produce good outcomes without mistakes for patients. When confronted with a question they cannot answer, the pressure to problem solve may prevent them from asking good questions or admitting that they do not know. So, instead of finding evidence that makes a difference to the patient, they fall back on anecdote or what worked with another patient. Over time, this pattern results in what Argyris calls "learned incompetence."[5]

Single-Loop Learning

Argyris calls the learning associated with problem solving "single-loop learning."[5] He uses the analogy of a thermostat that automatically turns on the heat when a room's temperature drops below a certain temperature to illustrate single-loop learning. The thermostat never questions whether the preset temperature (e.g., 72°F) is the right or best temperature; instead, the system works to restore the preset goal. In medical terms, a physician may see a patient who presents with a cough and diagnose acute bronchitis. The physician solves the problem by giving him a "first-line" antibiotic such as erythromycin, making the assumption that this infection is bacterial and will therefore respond to antibiotics. When the patient returns a few days later, upset because he is not feeling better, the physician gives him a "stronger" antibiotic. This is single-loop learning because the underlying assumption (the infection is bacterial; therefore, an antibiotic is indicated) is never questioned. Rather, adjustments are made to return to the status quo. Another example of single-loop learning among health professionals is the failure to consider countervailing or negative information because most of us tend to ignore things that do not agree with our initial diagnosis.

Double-Loop Learning

"Double-loop" learning, according to Argyris, is when a person engages in critically reflective practice by looking inward and considering his or her own behavior and assumptions and tries to understand how thought and action impact the situation.[5] Double-loop learners are also likely to change behavior after reflecting on it. This type of learning behavior is fundamentally important in shifting to a systems thinking mentality. A "double-loop" physician would question the assumption about the original treatment for bronchitis and consider other possibilities. He or she might think, "Perhaps the cough is caused by a virus; perhaps bacterial bronchitis does not respond well to antibiotics because the symptoms are related to the body's response rather than to the bacteria themselves. Perhaps the cough is not an infection at all and is caused by allergies, asthma, or acid reflux." The latter physician is more likely to help the patient because the physician has fully

explored all of the possible causes of cough and has moved beyond "solving" the problem to understanding it. She or he is also not afraid to admit not knowing the answer.

Argyris observes that most highly skilled professionals are skilled single-loop learners.[5] This is not surprising in organizations in which people are rewarded for having the "right" answers, acting quickly, and fixing problems. Professionals spend years working on degrees and mastering their crafts, all for the sake of solving "real-world problems."[5] In fact, Argyris explains that whenever single-loop learning fails for professionals, they become defensive, screen out criticism, and "blame" everyone but themselves.[5] Senge calls this the victim syndrome.[1] Medical training is very good at fostering single-loop learning in students but is less effective at developing double-loop learners.

Espoused Theory versus Theory-in-Use

The second problem Argyris identifies with regard to professional learning is a common assumption that getting people to learn is a simple matter of motivation.[5] He argues that learning is more than ensuring the right commitment and attitude toward it. Organizations must move beyond how people *feel* (happy about learning) to how they *think* about their learning. Only when professionals are willing to reflect on their cognitive rules underlying thought and action can true double-loop learning and systems thinking transpire.

Argyris found that professionals are very good at learning when it is change oriented and focused on external organization factors.[5] He found, however, that professionals resist learning when it calls for self-introspection and evaluation of one's own performance. Argyris further argues that failure to learn is grounded in embarrassment. Deep inward learning requires critical self-examination, which is often too threatening. Such learning can also cause learners to react defensively and protect themselves from being revealed.

What explains such faulty reasoning? Argyris has observed that professionals often behave differently than they profess they would. He calls this defensive reasoning.[5] What Argyris labels "espoused theory versus theory-in-use" characterizes this behavior. Espoused theory refers to the beliefs and behaviors that professionals say they follow. On observation, however, many professionals have been found to do the opposite of what they say they believe, and this is termed "theory-in-use." Sandvik demonstrated this phenomenon in a study comparing physician responses to vignettes for female urinary incontinence to their actual treatment of this condition.[7] Sandvik found that physicians tended to overestimate their real performance. Another example is a physician espousing a belief that patient control and involvement in end-of-life decisions are fundamental to his or her practice. Yet at the critical decision-making moments, the physician acts unitarily and with little regard for the patient, falling into a "doctor knows best" persona.

Learning Disabilities

Building on Argyris's work, Senge identified seven learning disabilities that are operational in most organizations, based on archetypal behavior.[1] These so-called learning disabilities operate on individual, group, and organizational levels. These disabilities prevent individual learning and combine to create dysfunctional systems that make it difficult to see the whole. The disabilities are listed in Table 1.

The first disability, "I am my position," refers to being so absorbed in a professional role (such as being a physician) that the person functions as a role, not as a whole human being. Certainly, the mythology of being a doctor plays into this disability as a near omnipotent fixer of health woes. This disability is also known as the hero syndrome, in which the person believes she or he is invincible and unaffected. Rather, she or he sees herself or himself as an actor on the system.

Table 1 Learning Disabilities

I am my position
The enemy is out there
The illusion of taking charge
Fixation on events
The parable of the boiled frog
The delusion of learning from experience
The myth of the management team

"The enemy is out there" is a disability of irresponsibility and blame. This nonproactive stance puts energy into blaming external entities for personal failure or troubles and is a symptom of single-loop learning. Physicians can fall into this disability when they start feeling like helpless victims of insurance companies, regulatory agencies, or large health care organizations. This disability is also known as the victim syndrome. This person does not view herself or himself as capable of affecting the system. Rather, she or he only feels maltreated by it.

"The illusion of taking charge" is the person who rises to the fore in moments of crisis or adversity and has to put a thumbprint on everything for it to pass muster. This often results in a controlling, catastrophe-loving behavior that prevents everyone from effectively addressing systems problems or engaging in double-loop learning owing to its reactive nature.

"Fixation on events" is the inability to consider the system and only treat the parts. For instance, many physicians are only concerned with reducing blood pressure in hypertensive patients rather than selecting the therapy that is most likely to improve the patient's quality and quantity of life. Optionally, amlodipine is a very widely prescribed and marketed antihypertensive that is excellent at reducing blood pressure but has never been shown to reduce all-cause mortality. Similarly, many physicians are concerned only with increasing the length of life, without considering the impact of intervention on the quality of life.

"The parable of the boiled frog" refers to the story of a frog that is thrown into a pot of boiling water and quickly leaps out. Yet if you put a frog into a pot of cold water and slowly heat the cauldron to boiling, the frog will die, unable to adjust to subtle changes in its environment. This disability points at our inability or unwillingness to pay attention to subtle environmental changes that will eventually have a significant systems impact. Physicians who are poor learners will eventually become boiled frogs, yet their learning pattern makes them blind to this reality.

"The delusion of learning from experience" is to convince yourself that you have seen this problem before and know just what to do. This fails to consider that many of the things we see today are new problems that demand new thinking. This orientation prevents having to think "out of the box." It also ignores the important limitations of clinical experience: we pay too much attention to the new or unusual, are too quick to draw conclusions about causality, do not measure outcomes consistently or systematically, and ignore nonconfirmatory data. This impedes learning, with the result that the best predictor of knowledge of blood pressure treatment is a physician's year of graduation from medical school.[8]

The seventh disability, "the myth of the management team," is a group that comes together, reaches surface agreement, but never shares deeply held assumptions. The group adjourns, and each member goes her or his separate way and does exactly as she or he pleases, regardless of group consensus. In medicine, groups often agree to adopt an evidence-based practice guideline that has the potential to improve the quality of care. However, because systems are not in place at the point of care to facilitate use of the guideline (i.e., make it hard to do the wrong thing and easy to do the right thing), physicians quickly forget about the guideline and practice in their usual manner. The unfortunate result of this disability is that the group functions with a lower than average intelligence than the group actually possesses.

Lessons for Practice

- We need to view our organizations as systems of interconnectivity. Individual, group, and organizational learning capacity can be improved through critical reflection, dialogue, and questioning.
- Systems thinking requires new approaches to organizational structure that effectively manage complex environments by moving beyond blame and regarding problems as originating from a system.
- Critical reflection on practice can help uncover learning disabilities and contradictions between thought and action. This thinking must not only be practiced but taught to others as well.

It would be easy to assume that all learners are created equally, but that is simply not the case, particularly when learners are challenged to apply new thinking to old problems. Not only do systems thinkers have to relearn how to learn, they also have to incorporate new learning designs into their organization structures to support other learners.

How Systems Thinkers Think

Systems thinkers are critically reflective double-loop learners who are interested in understanding how their actions shape reality. They also discipline their thinking toward understanding the whole and focus on seeing interrelationships and patterns in the situations they are facing. Systems thinkers also understand the role of feedback within the system and appreciate that feedback is usually not instantaneous. Systems thinkers are also nonlinear in their thinking. This thinking in circles, not lines, allows them to appreciate the complexity of the system over time and continue to raise new questions.

Systems thinkers ask more and different questions than nonsystems thinkers. Rather than breaking problems down into their smallest pieces by asking "What or who caused this?" they will ask, "Is there a pattern of behavior?" "Does the pattern change over time?" "What are all of the variables (including emotions)?" "What factors influence the variables?" and "What are the interrelationships?" Systems thinkers do not find satisfaction in problem diagnosis alone because this would be single-loop learning. Rather, they are interested in the patterns of behavior and other variables that caused the problem and in creating long-term changes that permanently prevent the problem in the future.

Nonsystems thinking is characterized by actions such as attempting to inspect quality into the system versus designing quality into the system. In other words, the system is set up to catch mistakes instead of prevent them. For example, when medical errors occur, the nonsystems response is to place blame and reprimand the person who made the mistake. A systems thinker would step back and examine medical errors over time to understand whether a pattern existed and whether it had changed. A systems thinker does not settle for blame but rather seeks solutions integrated into the process of care that make it easy to do the right thing and difficult to make an error.

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