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Perry R. Rettig
University of Wisconsin–Oshkosh

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“...Everything is interconnected and creating relationships and networks is a central task of school leaders.”

Can You Quantumfy That?

Perry R. Rettig, Ph.D.

Current educational practices are based upon the science of Newtonian or classical physics. This approach is flawed in that it is an inappropriate method to look at human, social, and dynamic systems. This approach is very appropriate for the study of closed systems like machines and clockwork mechanisms. But, as Margaret Wheatley (1994a, p. 29) posited, “*A mechanical world feels distinctly anti-human.*” A model derived from lessons learned in quantum physics is more appropriate. Quantum physics and the other new sciences include a set of scientific principles and approaches that are more conducive to studying open systems, such as the environment, social systems, and people. The traditional view is more rational and linear, whereas the new view is more intuitive and multifaceted. Again, the past view is more reductionistic and encourages competition, whereas the newer thinking is more holistic and encourages cooperation. While classical or Newtonian physics is an excellent science, it is not the science to be used in order to understand us and the organizations in which we live.

Classical Thinking

Classical physics seemed to provide the opportunity for scientists to better understand things. As the science explicitly suggests, if you can just break down the complex whole and study its parts individually, you can understand the whole and make predictions about the future. You can then provide an algorithm for success and for subsequent replication. This might work for machines and planetary movements, but cannot do justice to the understanding of the complexities of people and of the organizations in which they work. Unfortunately,

Perry R. Rettig, University of Wisconsin–Oshkosh

scientists and theorists in other fields have taken these fundamental principles of Newtonian physics and applied them to fields that don't fit the approach. For example, behaviorists like John Watson and B.F. Skinner applied this classical model of mechanistic linear prediction to the study of human life and behavior. However, the science is inappropriate here. Henry Stapp (1993) stated,

The behaviorists sought to explain human behavior in terms of certain relatively simple mechanisms, such as stimulus and response, habit formation, habit integration, and conditioning of various kinds. It is now generally agreed that the simple mechanisms identified by the behaviorists cannot adequately account for the full complexities of human behavior.
(p. 13)

Frederick Taylor then applied this same method to understanding how to make employees work more efficiently and how to provide the leadership to control the desired results. Stephen Covey explained his concern, “*You simply can't think efficiency with people. You think effectiveness with people and efficiency with things*” (1989, p. 169). The flaw lies in the belief that people can be dissected and understood and controlled like machines. It believes that leaders must motivate and think for their workers. It believes that work must be broken down into ever smaller parts in order to understand the whole. It does not take into account the human equation. It does not take into account how the parts effect the whole in interconnected ways that cannot be measured in isolation. It does not take into account the incomprehensible interconnectedness of the relationships within the whole. It does not fit the study of humans and their organizations.

Classical Schools

Still, our school systems are profoundly influenced by the Newtonian way of thinking. Our schools are organized and structured in a highly rigid, classical model. The supervision and evaluation of teachers, curriculum and instruction, and assessment of students also have very strong ties to Newtonian physics.

School systems are highly and rigidly structured. The hierarchy is a top-down model wherein different silos are aligned for efficiency and standardization. Most medium- and larger-sized school districts have a superintendent at the top of the hierarchy. Directly under them on the operational flowchart are either deputies, or directors, or assistant superintendents who have people in specialized

areas reporting to them. For example, there quite likely is a director of personnel, a director of pupil services, a director of business services, and a director of curriculum and instruction. Each of these directors will supervise five to ten people (coordinators) with more specialized roles and expertise.

Each of these major function areas (personnel services, business services, pupil services, and curriculum and instruction) have their own systems for accountability and bureaucracy. Tedious and microscopic budgeting processes provide accountability for business services, while personnel services uses very prescriptive collective bargaining agreements. Pupil services is clearly governed by federal and state laws which detail how students, teachers, and programs are identified, served, and evaluated. Curriculum and instruction has numerous committees that must go through various levels of permission for changes and textbook adoption. Student and curriculum evaluation are the hallmark of accountability in this function area. The entire organization is governed by hundreds of impersonal policies. Communication is clearly funneled through hierarchical flow charts. E-mail and memoranda rule the day. Individual schools are mirror images, at an albeit smaller scale, of these systems.

Principals are expected to provide clinical supervision and evaluation of teachers, as well as for classified staff. Sadly, teachers often complain that the supervision that they receive is more perfunctory in nature and meaningless to them (Rettig, 1998). They are observed very infrequently and then receive a written report as to the effectiveness of their work. The summative evaluations at the end of the year are typically based upon these infrequent observation reports. The observation and evaluation forms are very detailed in what is expected of the teacher and in the levels of performance. Each teacher is rated using the same forms. Individualized supervision and evaluation are the exception, not the rule. Forms rule the day and personal plans are cursory, at best. Consistency, control, and standardization are valued as desirable.

Teachers are typically not allowed to unilaterally choose their own textbooks and curriculum. They usually must follow the prescribed curriculum guide provided by the school district. Likewise, they must use textbooks that have been written by external publishers and adopted by the board of education. Many of these textbooks attempt to “teacher proof” the job of educators. There is renewed interest in state and national curricula. There is an

emphasis on consistency and standardization. Furthermore, there is an increasing emphasis at both the local and state levels for standardization of assessment and testing of students. In other words, the curriculum, the instruction, and the assessment tools are becoming more and more homogeneous and similar from school to school. Each school is beginning to look alike. Education expert, Linda Darling-Hammond (1999) explained:

One inheritance from the assembly line is the notion that decision making about curriculum, assessments, school design, and student progress is the purview of those who sit above teachers in a large bureaucracy. Teachers’ work consists largely of stamping students with lessons as they pass by, conveyor belt style, from grade to grade and class period to class period. (p. 32)

While classical scientific thought’s grip is still strong on our schools, there is hope. As leadership theorist Margaret Wheatley posited, “*There is a simpler way to lead organizations, one that requires less effort and produces less stress than the current practices* (1994a, p. 3). The lessons we are learning from quantum physics and the other new sciences support many of the more intuitive notions we already feel are best practices and also give rise to new thinking that may fundamentally change how education is approached in this new millennium. “*In the new science, the underlying currents are... giving primary value to the relationships that exist among seemingly discrete parts*” (Wheatley, 1994a, p. 9).

Quantum Thinking

Just what is quantum physics? Quantum physics can best be defined as a “*statistical theory that deals with probabilities*” (Stapp, 1993, p. 14). It looks at the interconnectedness of the universe at the subatomic level. Its language is the more intuitive and qualitative mathematics of patterns and relationships. Perhaps a theoretical example from this science and from another newer science will help.

Bell’s Theorem is also known as non-local causality. This experiment was done mathematically before it was verified in the laboratory. What John Bell discovered was the idea that you could pair together two electrons. Once they were paired together, you could separate them at macroscopic distances. After they were separated, the experimenter/observer could change the spin of one of the electrons. In a most interesting twist, the other electron would instantaneously change its spin in a corresponding

fashion even though it could not “see” the other electron. How could this be?

We are trapped by our limited, classical thinking. It is apparent that the two objects are separate, but that is the trap. The two objects are not necessarily two objects, or separate. They are interconnected, or one object. *“It is a quantum loophole through which physics admits the necessity of a unitary vision”* (Jaworski, 1996, p. 79). Interconnectedness and relationships are the center piece to this quantum world, and communication is the glue to these relationships. There is not an observer separate from the observed. The observer and observed are linked together as part of the whole. *“The work of Bell... has resulted in a strong experimental confirmation that in the quantum realm it is wrong to think of quantum phenomenon as independent hidden entities influenced by independent local circumstances”* (Pine, 1999, p. 22). Fritjaf Capra (1996) went further when he said,

Living systems are integrated wholes whose properties cannot be reduced to those of smaller parts. Their essential, or ‘systemic,’ properties are properties of the whole, which none of the parts have. They arise from the ‘organizing relations’ of the parts... Systemic properties are destroyed when a system is dissected into isolated elements. (p. 36)

From Bell’s Theorem, and from other quantum experiments, we learn of the unifying context of nature. We are not separate; we are interconnected. Isolating through measurement of individual parts does not give us a better understanding of the whole. The whole can only be understood by examining the entire system in a unified fashion.

Fractals prove to be yet another mysterious phenomenon in nature that can teach us important lessons. Examples of fractals can be seen in every day life. They can be created in the laboratory, and they can be created with a computer. Fractals are images or shapes that continually repeat themselves in finer and finer detail within a particular object. In nature, we see fractals in ferns, in mountains, in trees, and in clouds. When the observer studies one of these objects, he or she notices a pattern in the shape of the leaf or of the cloud. If one then looks even closer and closer, these same patterns continually appear over and over again at ever increasing microscopic levels. One can never seem to get to the end. It reminds one of walking into a hall of mirrors where two mirrors are facing one another and the same images continually reflect back upon one another at every decreasing sizes.

We learn a very special message from fractals. We learn that by trying to measure or observe something in ever increasing detail we really don’t learn anything new. Rather, we must look outward to the macroscopic picture. From fractals we learn to look for patterns and recurring themes; we must be patient. We need to look at the entire system over space and time. In other words, a quick one-time snapshot is not sufficient.

Quantum Schools

Quantum physics and the other new sciences have taught us some valuable lessons—if we listen. Some of these lessons seem common-sense, and so they support the work that some people and organizations are already doing. Other lessons are counterintuitive, and they make us strain to understand their meaning and application. Some of these require a great “leap of faith” while others feel more natural. In any case, a summary of these key lessons follows:

- (1) People and systems are subjective. Objectivity is an illusion, and measurement is subsequently subjective. How we see the world is less a matter of reality than a matter of what we choose to see. However, we help to create reality by our participation. Observation is a form of participation. We cannot be separate from what we observe.
- (2) All of nature is unified and interconnected. We are part of nature and are thus interconnected with all of nature and each other. *“The implications of this are profound... the physical world is an inseparable whole”* (Gilman, 1996, p. 12). This concept supports the point that we are part of what we observe, not separate from it. How can we be interconnected with what we are observing, yet not influence it? *“We have finally come to see the world as a single, albeit complicated, system, one immense set of interrelated pieces”* (Lipman-Blumen, 1996, p. 78).
- (3) A web of relationships is central to this unification. Just as living systems are integrated wholes, so too is everyone and everything interrelated. Therefore, identifying and embracing the web of relationships internal and external to the system is imperative. Everyone receives their identity from each other, and in turn, create the identity of everyone else. Measuring by taking apart the whole to observe individual parts, takes us further away from reality. The whole can only be understood by looking at the whole as a system; it needs to be observed over the breadth of time and space.

(4) Changes at the local level can make huge impact at the system level. Margaret Wheatley (1994a) said it best: *'Think globally, act locally' expresses a quantum perception of reality. Acting locally is a sound strategy for changing the large system... Acting locally allows us to work with the movement and flow of simultaneous events within the small system. We are more likely to become synchronized with that system, and thus to have an impact. These changes in small places, however, create large-system changes... because they share in the unbroken wholeness that has united them all along. Our activities in one part of the whole create non-local causes that emerge far from us.* (p. 42)

Application of the Lessons

Now that the lessons from quantum physics and the other new sciences have been identified, let's turn our focus to application of the lessons to several key attributes of school systems. As was mentioned earlier in this article, school structure, teacher supervision and evaluation, curriculum and instruction, and student assessment are but a few critical elements in education that are effected by our scientific stances.

School systems should be less isolated with silos and departments and should be more integrated horizontally and vertically. As information is the lifeblood of living organizations, communication from top to bottom and across the organization must be able to move quickly throughout the entire system. Furthermore, leaders of these systems must become more comfortable with ambiguity and with long-term goals, and be less concerned with control. In the words of Margaret Wheatley (1994b, p. 20), *"Leaders need to stop managing moments and analyzing results day by day, or even quarter by quarter, and look for deeper order that shows up as patterns of behavior."* Fritjaf Capra (1996) explained the new structure:

There is another kind of power, one that is more appropriate for the new paradigm—power as influence of others. The ideal structure for exerting this kind of power is not the hierarchy but the network... The paradigm shift thus includes a shift in social organization from hierarchies to networks. (p. 10)

Similarly, these organizational structures must be fluid and flexible. People must now be organized not in rigid permanent structures. Rather, they must be able to divide and join other people immediately for evolving tasks and

then divide again just as quickly. In other words, people within organizations (and even external to the organizations) must be able to quickly respond to changing conditions and reorganize for the new task at hand. Once the task is completed, different people go on to different tasks. Each time, different leaders may come to the front to meet these tasks. Lipman-Blumen (1996) posited:

Unlike the rigid hierarchies of formal organizations, the informal system may be composed of many loosely structured webs, outside the chain of reporting channels. More flexible than hierarchies, network segments can operate separately. They even break away temporarily for specific purposes and then regroup without damage—sometimes in new configurations. (p. 210)

Thus, the new school system needs to be less concerned with command and control. It must focus less on maintaining its present structure of departments and bureaucratic functions, and focus more on networking together all people within the system. More time should be spent on focusing on the clients—the teachers and students in the classrooms—and less on serving the dictates of administration.

As administration becomes less concerned with controlling and managing, their focus for teacher supervision and evaluation must change accordingly. Since living organizations are so highly complex and interconnected, it is impossible to draw a line of cause and effect—tug on one strand of the web and the whole web trembles. Therefore, it is imperative that administration abandon the reductionist philosophy of checklists to measure teacher skill parts. Rather, supervisors should spend a great deal of time looking for patterns and emerging themes. This will require long looks over space and time. In other words, supervisors need to examine the effectiveness of the entire system working together year after year, not on singular lessons from one teacher at a time. Furthermore, supervisors should welcome their intuitions. They should run from the attempt of control through the objective lens and embrace the subjective nature of working with people.

Perhaps the most important lesson to learn is that the leader's role will change. No longer will the role of the administrator be to control and evaluate. The role will now change to helping the professionals build networks and to rely on one another. Teachers need to become part of their colleagues' networks. More time should be spent observing one another for the purpose of professional development, not for accountability. Rather than be-

coming more and more isolated, teaching must search for relationship building.

As teachers expand their networks, they will take on more active roles in curriculum and instruction. Fewer levels of bureaucracy will permit information to flow quicker and be more appropriately used by those working most closely with the customers. Rather than standardizing curriculum, materials, and pedagogy, individual teachers and school sites must be given the opportunity to react to the particular needs of their unique students. In other words, as organizations are fluid and ever changing, so too are people. Thus, teachers must be able to respond to their own classes with unique approaches. Standardization can only guarantee mediocrity.

Curriculum and instruction will also need to change if we take the lessons of quantum physics and the other new sciences to heart.

Margaret Wheatley (1994a, p. 63) warned us, "Every act of measurement loses more information than it obtains."

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