

# Can U.S. Schools Be Managed for Improvement?

Applying systems thinking and measurement to accountability in public education

by  
**Leonard Cummings and Jim Lunsford**

**T**HE TERMS “MEASUREMENT” AND “accountability” are applied freely to education, though often inappropriately. They are usually applied to make the educational system reflect the high level of quality that everyone seems to desire. But what is quality education, and who determines this quality? Who is accountable for achieving quality in education? Can quality in education even be measured?

The aim of this article is to advance the understanding of systems thinking as it relates to public education accountability. An effort will be made to define the term “system” operationally (see the sidebar “An Operational Definition of System as Applied to Public Education”) and then apply this definition to all levels of public education to determine whether accountability measures can be administered to determine control of such a system or systems for the purpose of predicting the success of any improvement strategy.

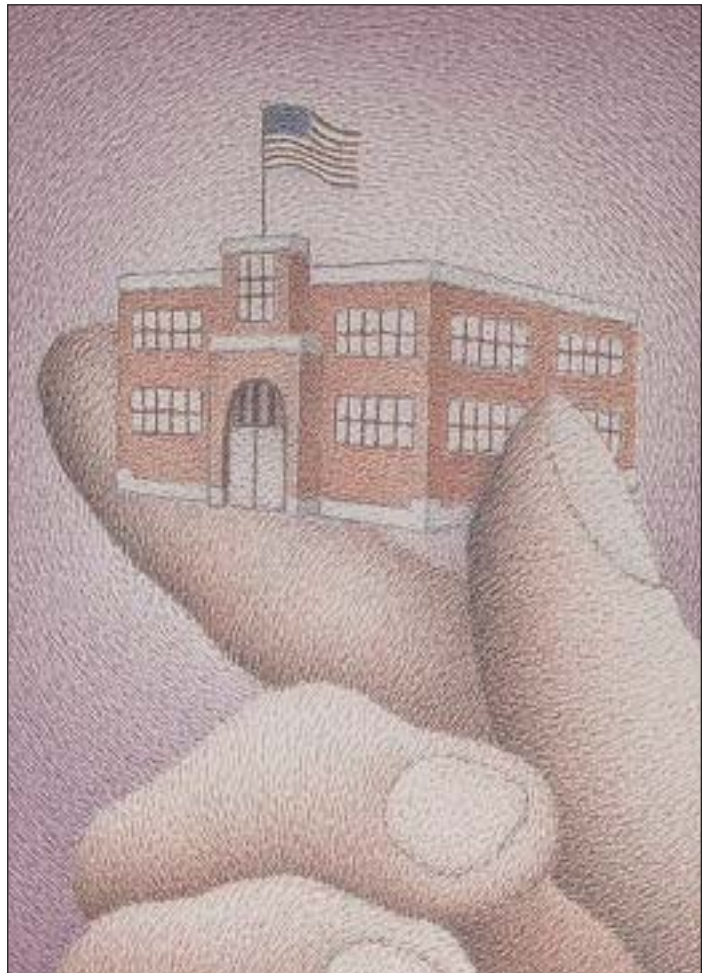
Four essential questions will be answered in this article:

1. When, if ever, is a legally established educational system a truly manageable system, statistically speaking?
2. Can system measures be used to assess such an operationally defined system for purposes of capability and predictability?
3. Can the unsuccessful attempts of the past and present to fix public education be explained statistically—that is, through quality management theory?
4. Are there better ways to improve public education? If so, what are they?

## Stability

System stability is an important concern. Usually, the larger the system, the more unstable it is and the harder it is to manage and improve. There is, however, more opportunity for tampering. Tampering is defined as overreacting to normal variation by making continuous adjustments often based on hunches rather than data. It results not in the desired improvement, but in increased variation.

When a system functions, feedback on its output



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## An Operational Definition of System as Applied to Public Education

The term “system” is applied in many ways to education, often with more confusion than clarity. A system in education can mean a legally established school district, a collection of schools, every aspect of a school or school district, or the core processes directed toward a common educational goal.<sup>1</sup> Because finding a defensible definition of an educational system is not easy, for purposes of this article, a system includes the following set of characteristics:

- There is an aim or singular purpose, to which an interdependent set of processes is directed.<sup>2</sup>
- There is an underlying structure of core processes that can be observed and charted.<sup>3</sup>
- The core processes act on input to produce output that addresses customer needs.<sup>4</sup>
- Interdependency is present and definable most of the time.<sup>5</sup>
- Variation is present in the output of these interrelated processes.<sup>6</sup>
- There is an optimal range of acceptable performance given all existing conditions.<sup>7</sup>
- A state of transition or change is ever present and continuous. In other words, the system is dynamic.<sup>8</sup>
- A state of dynamism is present though not always evident (e.g., the edge of chaos).<sup>9</sup>
- Adaptation, under conditions of constant change, is present, if not always observable.<sup>10</sup>
- The system undergoes spontaneous self-organization within boundaries.<sup>11,12</sup>
- The whole is greater than the parts. Sometimes the whole and sometimes the functional parts must be examined to understand the system,<sup>13</sup> but wholeness is the defining characteristic. Complexity grows out of the interactivity of one function, process, or system with larger functions, processes, and systems.
- Time is an important factor.<sup>14</sup>
- The system is improvable if it is in statistical control, and it is subject to obsolescence whether in or out of control.
- If the system or process is in control, it has a definable identity and a definable capability. Its performance in the future can be predicted. Once in control, the system can be improved by removing special causes of variation in its performance.<sup>15</sup>

- Well-intentioned but misdirected interventions to the system or its processes cause resistance to improvement.<sup>16</sup>
- Standardization can help or hurt the system's capability to produce satisfying results.<sup>17</sup>
- People are an extremely important part of the system, but are seldom to blame for any attendant inefficiencies.

In summary, a system is a complex collection of interactive and interdependent parts that function as a whole to accomplish a specific aim in an organized manner.<sup>18</sup>

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is used to help determine and ensure system stability. When feedback is negative, the system will often adapt in an attempt to be self-stabilizing.<sup>1</sup> Living systems will respond automatically to changes in their external environment. A living system will seek balance or homeostasis. Artificial systems must be guided to such a balance.

One must take care not to become too enamored with this concept of organizational balance. Balance—in terms of an organization or system meeting internal and external customer needs, pursuing its mission within its resources, performing within its capacity, and keeping within its core competencies—is generally healthy. But when balance is taken to mean control and order in the extreme, it can inhibit renewal, improvement,

and progress of the system or organization. Margaret Wheatley, a leading chaos theorist, writes that, “Dissipative structures demonstrate that *disorder* can be a source of *order*, and that growth is found in disequilibrium, not *balance*. The things we fear most in organizations—fluctuations, disturbances, imbalances—need not be signs of an impending disorder that will destroy us. Instead, fluctuations are the primary source of creativity”<sup>2</sup> Perhaps the paradoxical challenge for leaders is to develop order out of chaos. They must bring their processes and systems into control while at the same time “discomforting” areas of the organization that have become too comfortable doing things the way they have always been done. By doing so, leaders can move their organizations and systems

toward innovation and renewal.

Predictability is a key element of system management, and data are necessary for prediction. W. Edwards Deming said, "There is no true value of any characteristic, state, or condition that is defined in terms of measurement or observation. Change of procedure for measurement (change in operational definition) or observation produces a new number."<sup>3</sup> He called for operational definitions and cautioned people about the need to understand the difference between data, information, and knowledge. He recognized the importance of theory, the value of prediction, the preeminence of rational thought over common sense, and the need to understand profound knowledge—appreciation of a system, a theory of knowledge, an understanding of variation, and the psychology of human motivation.<sup>4</sup>

Deming stated that management requires predictability. This now seems self-evident. Indeed, how could anything be managed if one could not predict, with some degree of accuracy, the outcome of managing? Without predictability, one would just be tampering. Deming also stated that predictability requires a stable system. This requirement might not be intuitive to the manager with a phobia of statistics, but once an understanding of normal variability is acquired, this, too, seems self-evident. How can the normal variation of a system be predicted without some degree of stability in the forces that cause variation within the system? Any attempt to improve a system is an experiment. If these sources of variation are not predictable or controllable, there is no way to determine what causes any observed change.

### **Is the educational system really a system?**

A legally established entity labeled a system (such as a public school system) may or may not be a true system in the sense of the word as it is used in this article. This article sets forth some of the myriad characteristics that define a system, and these criteria must be applied to today's public school systems to see if they can be appropriately measured, brought into control, and, thus, managed for improvement purposes. One must determine whether, in the typical school system, there is a definable aim, evidence of variation, and a visible core process with definable inputs and outputs. One must determine if there is a definable performance range or capability, evidence of continuous change, and evidence of adaptation. One must determine whether there exists in-control processes, self-organization, interaction between the parts and the whole, a definable structure, standardization, and interdependence. These criteria must be applied not only at the classroom level but all the way up to the national level.

### **A national system of education**

Does the United States have a national education system with a definable aim, variation, a core process with inputs and outputs, and definable capability? Is this system self-organized, adaptive, and in statistical control? Does it have interactions between the parts and the whole, a definable structure, standardization, and interdependence between its parts? There might be a national education system, but it is neither in control nor predictable, and it is not currently manageable. One major problem is that there is no agreed-on, definable, measurable aim of education at the national level. There have been attempts, such as the Goals 2000 project,<sup>5</sup> to create lofty-sounding goals with no specific means of achieving them. There have been attempts to define needed skills, such as the Secretary's Commission on

Achieving Necessary Skills (SCANS) report.<sup>6</sup> There have been attempts by various groups, such as the National Teachers of Science, to define what should be taught in a particular content area. There is, however, no required course of study or curriculum on a national level that states or schools are required to follow. It is amazing that there is enough self-organization, adaptation, and tradition present in the system that students can move from a school in one state to a school in another state with little disruption in their education. Part of the credit for this degree of standardization goes to nationally normed tests such as the California Achievement Test or the Iowa Test of Basic Skills. These have served as benchmarks for many schools and have influenced what is taught.

### **A state system of education**

At the state level, there is usually a defined curriculum. In North Carolina, for example, there is a standard course of study for K-12 students. There are end-of-grade and end-of-course tests designed to measure how well students are doing on aspects of the prescribed course of study. There are minimum graduation requirements based on courses taken and competency tests passed. Beyond these minimum requirements, school systems are free to set additional goals and aims for their schools and students.

Of course, other questions surface. If some level of education is a system, is it, and its capabilities, measurable? Can a complex system like education be measured? Is there value or even validity in comparing legally established systems with statistically (that is, operationally) defined systems? Do statistical process control (SPC) measures have any place in performance assessment, improvement, or reform initiatives in education? Can SPC and similar tools be used to help explain why current and past reform efforts have not succeeded as hoped?

### **Measurement and accountability**

The key to measuring a process or system is to identify its aim and determine indicators that relate to its capacity in producing a product or service that consistently delights its customers—thus meeting its aim. Deming, however, reminds that "the customer expects only what you and your competitor have led him to expect,"<sup>7</sup> implying that quality has internal as well as external factors. If Americans were asked to rate education in general, a large percentage would probably give a negative response. Conversely, if asked how they would rate their local education system, a large percentage would likely respond positively. Some members of the press and some politicians have made careers of sounding the alarm about education (with a capital E), while at the same time praising the local education system.

J.M. Juran stresses "fitness for use"<sup>8</sup> as part of a definition of quality. Deming often stated that high-quality carburetors were made unfit for use by fuel injection. Hence, innovation is key to maintaining quality. This may seem frightening to educators when one considers that schools have changed their delivery system very little in the last 100 years. The advent of microchip technology and the shifting economic and political landscapes, however, are likely to assault public educators' resistance to change. Thus, system obsolescence is a subject worth close scrutiny by educators.

Public educators seem to know intuitively that what is truly valuable and lasting about their work is, in the words of Lloyd

Nelson, unknown and unknowable.<sup>9</sup> They also seem to realize that their product or service (i.e., educational opportunity, teaching, curriculum) is always useful. The delivery system, however, seems to be the foremost issue of concern for educators and communities alike.

Educators might be able to measure student achievement or process results in a narrow sense, but can the education system really be measured? If the answer is yes, is the purpose, then, to grade, classify, rank, and evaluate schools, school systems, students, teachers, and administrators? Surely not, if the need is to remove fear from the work environment.

### Ranking and grading U.S. schools

Americans are enamored with competition, keeping score, determining winners and losers, and otherwise discriminating between those who are on top and those who are not. This is done with sports teams, businesses, entertainers, and public schools. But what is the value of this activity? Is the purpose to grade and classify or to improve? Grading and ranking schools and school systems is not the same as improving them. Unfortunately, many policy makers do not understand this difference. Ranking involves competition. Sports teams, for example, improve by recruiting better players than their competitors and by having better game plans. In sports, someone has to lose; players and teams that do not make it are eliminated. The goal of sports is to select and sort. The goal of education, however, is to accept all students who come in the door and help them achieve their maximum potential. Schools are not in the business of entertaining fans; they are in the business of helping students.

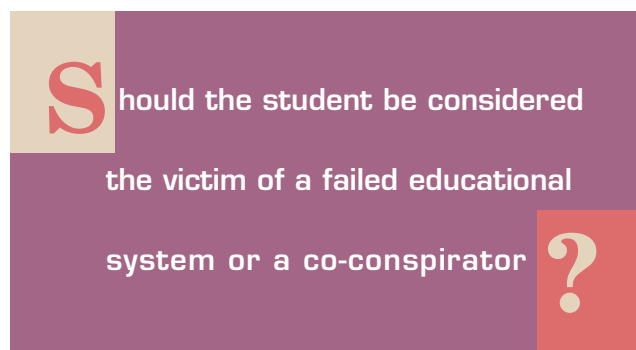
Ranking a school system based on test scores will not show how well it is achieving its aim. If all school systems are failing, all are doing mediocre, or all are performing at a superior level, there will still be a first-place school and a last-place school. One alternative to ranking is to use control charts. If a control chart is used to compare a group of classes, or K-12 systems, there will be, at most, three groups: Those above the upper control limit, those below the lower control limit, and those within the control limits. Those within the control limits should not be ranked. If all three groups are present on the chart, the low performers need to be dealt with first. If the time factor is removed from the charts, however, some performers will probably be misidentified as being in control. Extending charts over several years will help eliminate this problem. Also, using control charts with large groups reduces their sensitivity. Perhaps the biggest advantage of using control charts is that arbitrary rankings are eliminated. In such a scenario, competition gives way to cooperation, and schools and school systems become more willing to share their improvement innovations.

### Quality and accountability in education

As Deming says, “A product or service possesses quality if it helps somebody and enjoys a good and sustainable market.”<sup>10</sup> Surely education helps those who use it, but is its market eroding? Are education’s customers beginning to respond to innovative delivery systems outside of public education? Deming makes a pertinent point when he states, “People are asking for better schools, with no clear idea how to improve education, not even how to define improvement of education.”<sup>11</sup> Perhaps this is the key challenge for educators: to lead customers to define their expectations and then innovate education’s processes and

systems to exceed these expectations to the delight of all concerned.

If this challenge is to be met, who should be accountable? Can accountability be fixed for a system as complex as public education? What is the role of the students? What is the role of parents, business leaders, governing bodies, and administrators? If a school or school system is not performing well, who is at fault? Can such a thing be determined? Using the definition of system presented earlier, it would appear that the *wholeness fac-*



*tor* should come into play here—in other words, everyone involved is accountable. Deming, however, provides the reminder that “quality is everyone’s job, but management’s responsibility, working with the customer.”<sup>12</sup> With this in mind, one begins to see that education’s overemphasis on standardized test scores may not tell the whole story. It is likely that the true aim of education (joy in learning, creating a desire for learning) is not measurable. The cost of *not* learning, while surely high, is also unknown and unknowable. Who is to say that low standardized test scores are a measure of poor teaching? If the education system is a complex collection of interactive and interdependent processes and players, how can one component, teachers for example, be singled out as at fault? (The adage that everyone’s responsibility is no one’s responsibility might also apply here.) Should the student be considered the victim of a failed educational system or a co-conspirator? When poor report cards on the school system come out, who takes the business community to task for its role in the process? If teachers and administrators can be blamed, their co-conspirators can be exonerated. But is fixing blame preferable to fixing the system? Is the aim of current educational accountability practices to improve programs or engage in politics? If the legitimate aims of education can be agreed upon, and if those aims can be operationally defined sufficiently to be measured, then the question can be asked whether a particular educational system is achieving those aims. If the aim is having students achieve the SCANS skills, then the smallest accountable unit should be the K-12 school system. Optimization should focus on a school system, not an individual school or an individual teacher.

### The challenge for management

If a school system is treated as a logical subgroup and a comparison of school systems demonstrates an out-of-control system of education, how much more would it be out of control if the scale were decreased, thus increasing the sensitivity of the control chart? Management must decide whether to try to improve the total system or to concentrate on fixing a subsystem. Ranking systems will not help make this decision.

Blaming workers at the bottom of the ranking will not help either, since there will always be someone at the bottom of a ranking, no matter how good or poor the performance. In fact, if education truly is a system, management is responsible for 80% to 90% of the variation found therein. The first question to ask when comparing subsystems is whether any observed difference is real or due to random variation. In other words, are samples being drawn from the same bowl? If not, this must be addressed before any rational attempt can be made to improve the system or, indeed, before there can even be a system to improve.

### There is a better way

To start improving the system of education, educators must agree to shift their current paradigm of educational accountability. The following steps can make a good start:

- Operationally define “system” as it applies to the educational setting. Base this definition on the goal of delighting both internal and external customers.
- Focus educational assessment on process results for improvement rather than ranking and assessing blame.
- Match assessment results to operationally defined processes and relate them to the aim of the enterprise. The higher the process level, the more difficult this will become, because the ultimate aim of the system, being value driven, is likely not measurable.
- Focus on core system processes. Do not assign a capability to measures that were never intended by the designer of the assessment instrument.
- Measure the process over time and/or with multiple data points to determine system capability and control status.
- Seek to improve only processes and systems deemed in control. To do anything else is tampering, no matter who does it.
- End the practice of ranking students, teachers, schools, or school systems. No single entity can ever be responsible (and thus solely accountable) for a process’s or system’s production capability. Educational systems are too complex for this. Focus instead on the concept of shared responsibility.
- Seek points of leverage when predicting improvement strategy results, and use objective data to help determine these leverage points. Use the plan-do-study-act cycle.
- Focus on the interactions of people and improving work processes rather than keeping score in order to fix blame. Focus on the interrelationships of processes and people.
- Encourage innovation and risk taking on the part of producers rather than injecting fear through numerical goals.
- Focus on reducing variation in basic system output through continuous process improvement. Do, however, encourage variability in students’ application of skills and knowledge.
- Focus on intrinsic motivation and de-emphasize or eliminate external reward strategies. If rewards are used, focus on team-based incentives and/or recognition of the total organization.
- Study the whole system and consider any assessment used (assuming any such measure is valid) as a measurement of the whole rather than a single part.
- Involve all partners, including parents and students, in the educational improvement initiative.
- Educate everyone in the principles of quality management and systems thinking. Embrace and apply profound knowledge.
- Align the big-picture goal (macro) with goals at the lower

levels (micro)—where the process is actually carried out. Do not assume that measuring at one level means all levels have been measured.<sup>13</sup>

Improvement of education through the application of quality principles is, in the end, a people development enterprise. Profound knowledge must be developed in everyone involved with the educational system. Educators, better than anyone, perhaps, should be capable of accomplishing this transformation of thought and action. To do otherwise is to invite, and deserve, obsolescence.

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