Applying Quality Theory to Educational Systems

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The purpose of this white paper is to discuss how principles coming from the quality world and science can be used and applied to Educational Systems and Schools, by taking into consideration that "Applying Quality Theory to Educational Systems" is indeed quite relevant to achieve and improve Quality in Education. It is the sixth paper in a series of thoughts collected, organized, and promoted by the Quality in Education Think Tank (QiETT) of the International Academy for Quality (IAQ).

The first paper addressed a broader scope of topics and put into perspective the overall field of "Quality in Education", which set a common ground for further reflection and guidance of QiETT activities. The forthcoming papers, such as this one, focus around more specific subjects and delve deeper into particular topics based upon the collection of international inputs from quality and education experts.

To date, the collection of white papers comprises the following titles:

"Quality in Education: Perspectives from the QiETT of IAQ"
"Large Scale Training of Quality Professionals"
"Inclusive Quality of Education"
"Continuing Education in Quality Improvement for Healthcare Professionals and its effects on organizational improvement"
"Current Societal Challenges to Quality and Quality Management in Higher Education"
"Applying Quality Theory to Educational Systems"

1. Introduction

The purpose of this paper is to inform and discuss how quality practitioners (those who teach and apply quality methods as professionals) approach the application of quality theory and practice to the Education Sector. This paper is not a review of the sizable literature about quality as seen from within the educational community, but instead reviews how established quality theory and methods can be used to enhance educational systems.

2. What is Quality?

As a discipline, quality is first and foremost about the study of change. The philosophical roots of the quality discipline are found in the work of Alfred North Whitehead, whose work influenced the first pioneer in the quality discipline, Walter Shewhart. Whitehead observed that the world consists of interrelated processes that are always subject to change. The challenge for humanity in an everchanging world, Whitehead asserted in the 1920's, is to identify which things to conserve from change and which things to change, evaluating the results of that change (1).

Walter Shewhart acknowledged his debt to Whitehead in his writings and focused his research on the nature of change in processes. He studied change in processes as either being inherent in the system (now referred to as common cause variation) and changes which are introduced into a system by special actions (referred to as special causes of variation). Shewhart introduced the control chart as a statistical tool for understanding which changes in a process are due to common causes and which are due to special causes (2).

Shewhart found that to understand change in systems, we must focus on specific, measurable characteristics. Again, Shewhart drew upon Whitehead's observations about the nature of data and measurement in the real world and our need to constantly compare what measurement data shows us against our theory and knowledge of how the world functions (3). The understanding of change is based on the measurement of variation in specific quality characteristics in a system and our perceptions about the meaning of this variation.

As part of his study of change, Shewhart also introduced a systematic approach to planning the introduction of potential changes, the implementation of change, the analysis of the impact of a change, and institutionalizing a change that has positive results. Working at Bell Laboratories, Shewhart served as a mentor to W. Edwards Deming, who championed Shewhart's work, introducing the terms common causes and special causes to the understanding of variation, and framing Shewhart's systematic approach to analyzing change as the Shewhart Cycle (4).

Deming served actively with the efforts to enhance the production of military materials during the Second World War and was invited by McArthur's occupation government to teach statistical quality control to the Japanese. This stimulated the quality revolution in Japanese

industry that propelled their companies in terms of international competition and market dominance and resulted in American companies echoing the Japanese by embracing Shewhart and Deming's understanding of quality broadly in the 1980's. These quality practices have been widely embraced today in Europe, Asia and across the world in the area of manufacturing and are increasingly being successfully applied in other areas as well, namely to the field of health care.

Other actors in the quality field have made significant contributions to the modern understanding of quality. For several decades, Joseph Juran provided a comprehensive set of methods and strategies for sustaining and protecting the quality in systems, diagnosing failures in quality, and systematically improving quality, many of which comprise the current practice known as Six Sigma. In Japan, Dr. Kaoru Ishikawa worked with Dr. Deming and Dr. Juran to introduce additional methods for examining variation in processes, such as the Cause-and-Effect diagram and developed a structured approach to involving work groups in quality control and quality improvement known as Quality Circles. Deming, Juran, and Ishikawa all embraced additional methods from the field of industrial engineering, such as flow charting, to aid in controlling and introducing change in work systems.

Quality, therefore, is the understanding of change in systems – particularly regarding the variation inherent in a system and the variation that is introduced to a system. Quality practitioners focus on maintaining the stability of systems by preventing adverse change (quality control) and also introduce change to improve processes and outcomes (quality improvement). In some cases, quality practitioners are called upon to analyze the causes of failures and to develop corrective actions to bring systems back under control. And in other circumstances, quality professionals help organizations redesign stable systems through a variety of approaches to innovation that are documented in the quality literature. The decisions regarding what changes to prevent and what changes to implement are based on assessment of data related to selected quality characteristics.

3. Education as a System of Processes

All educational systems consist of processes that are constantly changing. From the perspective of the quality discipline, based namely on Shewhart and Deming's views, educators may not fully recognize what is happening in these complex systems in terms of the causes of variation, and people may misinterpret the meaning of the data that can be provided in order to serve their own interests and needs.

Educational systems all consist of interrelated processes, such as the teaching of a specific course, the design and implementation of an academic program, the hiring and support of faculty, the process of admitting students, the process of grading academic work, the processes of advising, mentoring, and tutoring students, the processes of providing and evaluating general

education, the processes of using libraries and data bases, the support processes such as residence halls, counseling, food services, building planning and maintenance, and campus security, and extra-curricular processes that shape the culture of an institution, such as athletics, student organizations, marching bands, and student governments, not to mention the increasing role played by IT, access to online contents, or Wifi coverage. Each of these components of an educational system can be viewed as a process with its own quality characteristics. Each can be studied from the perspective of inputs to the process, actions that occur in the process, and outcomes that can be measured. Each of these processes is subject to variation that may be common to the system or the result of special causes. Without appropriate control charts focused on specific quality characteristics, educators cannot properly identify the right causes of and for change in educational processes. Furthermore, big data connected with education is also becoming available and can be explored, for instance using machine learning or data visualization and analytics tools, in order to achieve similar goals over more complex data sets.

Over the past forty years, a discipline that focuses on assessment has taken root within the educational profession. This focus on assessment was stimulated by the focus on Deming's methods in the business community (5; 6). Assessment methods encourage educators to examine their work as processes and encourage the identification and measurement of specific quality characteristics, but rarely employ the essential statistical methods, such as control charts, necessary to understand the nature of variation being observed in educational processes. Furthermore, assessments often ignore a proper use of statistical terms, such as what actually constitutes a trend in data. However, some in the academic community have opposed the use of assessment methods because of their early association with quality improvement in industry back in the 1980's.

From the perspective of the quality discipline, however, the introduction and growth of assessment methods have been a positive development in understanding, controlling, and introducing change in the highly inter-related processes within any educational system. Unlike change in a manufacturing setting, where conditions can be adjusted and analyzed within a relatively short cycle time, the cycle time for change in educational processes may take years. Practitioners may wait for years to determine the result of changes introduced in a pre-school curriculum, namely regarding the results of changes in how math is taught in a school system, or to determine whether changes to teaching methods in first-year engineering classes better prepare graduates for work in the engineering field.

And unlike quality control and improvement in the manufacturing environment, there can be difficulties with agreeing on which quality characteristics should be measured within educational processes. Do scores on standardized tests really reflect subject matter expertise or are they subject to cultural bias? Are educational bodies of knowledge merely constructs based on ethnocentric world views and bias? Is the content of education in a community based on political objectives that support or challenge the social and economic status quo? All of these

considerations can influence which characteristics of an education system are selected for measurement in terms of inputs, processes, and outputs.

4. The Functions of Education

Historically, educational systems have performed several functions. One might expect for its foremost function to be facilitating learning among students. Learning can mean the mental acquisition of information, the acquisition of languages, the understanding of theories, and obtaining the skills to apply knowledge and thinking processes to real-world settings. A second function of education is to filter out individuals who do not, for whatever reason, measure up to the standards of a discipline or profession. Most students will not have what it takes to become a surgeon or to conduct scientific research, to design a bridge, or to manage pharmaceuticals. Educational processes facilitate learning in all of these areas, but they also thankfully filter out many aspirants who cannot make the grades through what is known as academic rigor.

Since evidence shows a positive relationship between advanced education and lifelong financial earnings, many people want to gain as much education as possible, but education must be earned and achieved. It is a meritocracy, not an entitlement, but some students have distinct advantages in successfully mastering academic subjects based on financial resources that provide stronger preparation and tutoring and the ability to attend school without having to simultaneously work or bear the stress of taking on significant debt, or going hungry. This opens an entirely different sphere of consideration regarding the roles that educational institutions may play within various economic and social constructs, including broader issues, such as the preparation of citizens for the present societal challenges, or the implementation of inclusive educational systems and schools.

5. Quality and Peer Review

Educational systems overcome the problems of uncertainty about which quality characteristics to employ by relying on peer review to determine what should be measured, which measurements have value, and how the design, conduct, and assessment of individual classes, academic programs, and institutions should be carried out.

One result of the Assessment movement in education has been to shine more light on the need for systematic approaches to the peer review process within educational settings. This appears to be leading to more explicit conversations about the efficacy of academic programs and is increasingly documented by specialized and regional accrediting agencies.

Accreditation is the macro-level vehicle for quality control and quality improvement in educational systems, whether by state agencies, peer review of specific academic programs, or

peer review by regional or other accrediting bodies. What state agencies and accrediting bodies often lack, however, is a grounding in the quality discipline. Those involved in government agencies may be even further away from understanding the work of Shewhart and Deming as they are sometimes coerced by political considerations to adopt positions that are even sometimes contrary to the established quality body of knowledge, as we will see namely in further examining Deming's work under the context of education. These attitudes may have quite a negative impact over the "real" education quality, since they may lead to a wrong association of quality in education mostly with paperwork and administrative evidence of compliance with sometimes arguable and blind accreditation standards.

6. Quality Concepts Applied to Education

It could be therefore quite helpful to educators, academic administrators, school superintendents, school boards, trustees, accreditors, government regulators and societies in general to consider several sources of information from the established quality discipline when addressing quality in education. For this paper, we will examine the application of Deming's 14 Principles to education and will review the framework for quality in education developed for the Malcolm Baldrige National Quality Award. Although there are many education specific models and frameworks that have been developed for different levels of education, types of schools and countries, it would be greatly important for them to take into consideration the real fundamentals of quality and excellence, as the ones expressed by the mentioned two frameworks, whose implications for quality in education we will briefly discuss in the next paragraphs.

6.1 Deming´s 14 Points

In the early 1980's as hundreds of business executives in the United States flocked to his seminars at George Washington University, Dr. Deming summarized his views about how organizations and leaders need to understand and act regarding quality – the study of change. Deming referred to these views as his 14 Points, or 14 Obligations for management. This summary of the 14 Points is edited here to focus on how Deming's views can be applied to the Education sector (7):

1. Create constancy of purpose for improvement of educational processes and outcomes. Leaders in education must deal with two types of problems – problems of today and problems of tomorrow. Leaders become bound up in the problems of today – hiring faculty, scheduling classes, discipline cases, and all of the other day-to-day, year in and year out issues, including complaints from parents and the community. Problems of the future require constancy of purpose to support innovation, staff development, improve

teaching methods, and working with the community or institutions that send you students to help them be better prepared, with a longer term strategic insight.

2. Adopt the new philosophy.

   Embrace the emphasis on setting high standards of performance and recognizing and rewarding excellence.

3. Cease dependence on mass testing.
   It is expensive and you cannot achieve excellence by mass testing. Focus, instead, on smoothly operating your educational systems and use statistical measures to determine whether academic work in a system is in statistical control. Understand what the sources of variation are in student work, rather than paying too much focus only on the final examinations conducted over the complete universes of students as the predominant quality inspection mechanism or single educational goal.

4. Examine how you approach the inputs into your system.
   Do not be forced into simply selecting the lowest bidder when selecting textbooks, buildings, school buses, or materials. Build long-term relationships with the neighborhoods and schools that feed students into your system, and try to get as good students, teachers and staff as you can, as a school.

5. Constantly improve your educational and educational support processes.
   Excellence is built into the system as you design facilities, curriculum, pre-requisite requirements, tutoring resources, laboratories, and security. Improving processes includes the process you use to select people, assign them, train and develop them and support their continuing education. Putting out fires is necessary, but it is not real improvement of the process.

6. Academic leaders need to understand and stay current with the overall system - student selection, classroom teaching, administration, and career counseling.
   Academic leaders need to also be well grounded in understanding how students learn.

7. Adopt and institute leadership.
   The job of management is leadership, not supervision. Leaders enable organizations to address both the problems of today and to invest time and energy in improving processes to address the problems of tomorrow. Leaders must understand and recognize which

problems are due to special causes and which are built into the system and can only be addressed by changing the system, and this is somethings that needs to be applied to schools and education as well as in other organizations or processes.

8. Drive out fear.

   No one can perform their best unless they feel secure. Secure means without fear. There is fear of knowledge in some communities, so some teachers are fearful of teaching some subjects or in certain ways, just like students may be afraid of trying certain new approaches or providing different sorts of answers. Teachers can be fearful of being punished for low student test results. Schools are fearful of being labeled as failing. Management may intimidate staff and some staff may be intimidated by parents or some students. Annual performance ratings often contribute to fear and detract from teacher and support staff performance, and the same also applies with regards to student assessments and ratings. By removing different layers of fear, schools, teachers and students are much more willing to innovate and experiment new ways of doing doings, rather than remaining conservative and doing things as usual (classrooms of today are too much similar to the ones of 50 years ago, although the world has changed dramatically over these decades).

9. Break down barriers between staff areas.

   Make sure that all teachers and staff and administrators have the opportunity to identify and discuss problem areas without fear, regardless of any existing school silos. This is vital in order to understand and address factors that can impact student performance such as hunger, bullying, and drug use, among many other issues, as well as to get a broader, integrated view and management of the student learning journeys. People who make curricular decisions must interact with classroom teachers and the organizations that hire graduates or accept them into higher levels of education. Nothing in the educational system happens independently. Everything is inter-connected and all sub-systems co-vary, so that process views and networking efforts will increase quality in education.

10. Eliminate slogans, exhortations, and targets.

    Slogans and exhortations to "be the best" school sound great but they do not change the system. It is far better to understand the performance of the educational system – what is stable and what is changing due to special causes. It can be important for students, teachers and schools to have goals, but achieving goals depends on improving processes and changing actions. Too much focus for instance on rankings of schools will therefore not allow them to achieve real improvement in the most efficient ways.

11. Eliminate quotas and false measures.

Understand that by definition, half of the students in a school are above average and half are below average for any measurement you make with that student population. This includes height, weight, reading ability, math skills, as well as the ability to run and to play music. This also applies to teachers, principals, superintendents, professors, deans, presidents, trustees, school board members or staff. Within a population, half are always below average on any measurement (from a more technical statistical view, do not forget that this is by definition what the median stands for). Furthermore, there will always be a top 10% and a bottom 10% with any type of variables data. Labeling the bottom 10% as "failing" is misleading and counterproductive. The system will produce the learning it is capable of producing. Quotas and false measures will not change this and may make the situation worse by instilling fear among students and teachers. To improve learning outcomes, one must change the system, and work around its common causes of performance. Therefore, appropriate caution should be paid for instance in defining targets such as percentages of failing students at any given year or course.

12. Remove barriers that rob educators of pride in their profession.
Educators make significant personal investments in time and finances to prepare to be effective teachers and educators. Their salaries, benefits, and retirement plans should reflect their status as professionals, as from a societal view teachers need to be highly regarded and rewarded. All evidence collected does show that indeed communities and countries that value and nourish good teachers tend to have much better quality in education.

13. Encourage education and self-improvement.
Educational systems must support their employees in pursuing graduate degrees, attending conferences, presenting papers, and pursue other professional development opportunities. This also needs to include teachers and education leaders, taking into account that students and education are changing at a very fast pace, so that both schools and their professionals need to have lifelong learning as part of their professional evolution.

14. Take action to accomplish the transformation in the previous 13 points.
Only management has the authority to make this happen. The faculty cannot do this on their own. Recognize that every job in an educational system is important and is part of a process. These processes are inter-connected. Management must lead the improvement of each process, but through different levels and layers of leadership, since schools are communities, rather than "one man or women shows".

Deming's work was punctuated by a number of pithy observations, as we are able to show above. When it comes to changing systems, Deming knew it takes careful study and time, noting

that there is no "instant pudding" and "deep knowledge" is needed. Simply controlling quality is not enough, he observed, as he asked who wants to be the best producer of buggy whips? One should never underestimate or neglect the power of these 14 principles, when properly adapted and implemented in education and schools.

6.2 Malcolm Baldrige Criteria

During the 1980's, a group of quality professionals worked together to develop the criteria for a national quality award in the United States comparable to the highly esteemed Deming Prize awarded each year in Japan. This award program received approval from Congress and was named after the Secretary of Commerce during the Regan administration, Malcolm Baldrige.

The Baldrige Criteria provides a yardstick that describes performance excellence for any organization. From its earliest days, a set of these criteria was customized for the Education Sector. Several school systems, colleges and one university have received wide recognition through receiving the Baldrige Award.

Anyone interested in improving an educational system can learn a great deal by using the Baldrige Criteria as a thorough framework against which to compare their institution or school. As in the overall Baldrige framework, the Education Criteria guides an institution through thinking about seven areas that comprise essential systems and activities within any educational organization, with specific questions to ask that will prompt critical thinking and can lead to improvement of processes and results. More than the award, the Baldrige Criteria through self-assessment can drive significant improvements in schools and education.

Each Baldrige criterion leads to critical reflection on how the organizations address the issues covered by each criterion, the maturity of its approaches, the breadth in which they are implemented, and evidence of improvement in the area being considered. The following are brief summaries of each of the seven Baldrige criteria for evaluating and improving education institutions (8):

Leadership – The Baldrige Criteria starts with examining how the educational organization's senior leadership takes actions to guide and sustain the school. How do the senior leaders lead? How is the institution governed and how does it meet its social responsibilities?

Strategic Planning – This category delves into how the organization develops its strategic objectives, how it develops and implements action plans, and how progress is measured. An organization's action plans and their performance measures are reviewed and continuously improved.

Student and Stakeholder Engagement – How does the institution select its educational programs, offerings, and services? How does the school create and sustain a student-focused culture? How does the organization engage with other stakeholders? How does the institution obtain and use information from students and stakeholders? What is the evidence of this being the case?

Measurement, Analysis, Knowledge Management – How does the school measure, analyze and improve performance at all levels and in all parts of the organization?

Workforce Engagement – How does the school engage, compensate, and reward the workforce for achieving high levels of performance? How does the institution support learning and development among the workforce? How are new staff recruited, hired, and oriented? How is the workplace climate assessed?

Process Management – This criterion examines how the school designs, manages and improves its key broad work systems. How are specific work processes designed, implemented, managed, and improved? How does the organization prepare for emergencies?

Results – What are the school's results in terms of student learning outcomes, stakeholder outcomes, budgetary performance, workforce outcomes, process effectiveness, and leadership outcomes? What is the evidence of improvement in each of these areas? How do the organization's results compare to peer institutions and benchmarks?

There is a great deal of variation when academic disciplines, regional associations, and different state and government agencies each attempt to design their own set of performance criteria to facilitate assessment and peer review. The potential value of a peer review will be enhanced or diminished depending on how thorough the criteria for comparison may be.

The value of peer reviews can be greatly diminished when individual reviewers rely only on their own experience and opinions as to what constitutes good practice. Most peer review processes created with the education community provide little or no training to would-be reviewers. The quality of these reviews always depends on the combination of people selected to serve on a team, which can vary greatly. However, Baldrige Examiners must undergo rigorous training before they are allowed to review an organization's performance, and this is something that should also be accounted for any school assessment and by accrediting entities.

Furthermore, the Baldrige Criteria provide a well-tested set of criteria that is well grounded in the quality body of knowledge. The Baldrige process also provides thorough training for those engaged in this form of peer review, guidance on how to visit an organization, guidance on meaningful evidence and presentation of data, as well as clear guidance on how to score levels of performance excellence and how to write a feedback report. Similar experiences can be found also elsewhere and will be quite beneficial for those interested in the development of education quality, such as is the case namely of the EFQM Model of Excellence (Europe) or the Government Excellence Model (Middle East).

Further information on the use of the Baldrige Criteria in education can be gained from reading materials by Dr. Brent Ruben, from Rutgers University, and by visiting the Baldrige web site at http://nist.gov/baldrige where there are numerous descriptions of Baldrige-winning organizations in the Education Sector. A similar experience, regarding the adaptation and large scale implementation of the EFQM Model of Excellence at over 40 Portuguese Schools was led by Pedro Saraiva, now Dean of NOVA IMS, and described in the literature (9).

7. Conclusion

Quality deals with the study of change, rooted in the philosophy of Alfred North Whitehead who influenced the pioneers in the field, such as Dr. Walter Shewhart. The understanding of change in the quality body of knowledge has be applied to manufacturing, the operation of businesses, government agencies, and non-profit organizations, the administration of healthcare, and organizations that provide education. The assurance of quality in educational systems and the improvement of the quality of educational processes and outcomes can be enhanced when educators reflect on their substantial body-of-knowledge through the lens of the quality professionals and frameworks, as important drivers and leverages for further defining and achieving quality in education.

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