FLASHES OF INSIGHT – The Many Pathways to Creativity and Innovation

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The purpose of this white paper is to explore innovation.

It is the 14th 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 on more specific topics and delve deeper into particular topics based upon the collection of international inputs from quality and education experts.

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

1-"Quality in Education: Perspectives from the QiETT of IAQ"
2-"Large Scale Training of Quality Professionals"
3-"Inclusive Quality of Education"
4-"Continuing Education in Quality Improvement for Healthcare Professionals and its effects on organizational improvement"
5-"Current Societal Challenges to Quality and Quality Management in Higher Education"
6-"Applying Quality Theory to Educational Systems"
7-"Training and Teaching Statistical Methods for Quality"
8-"Simple Hints to Help Trainers Improve Training Quality"
9- "Student Quality Circles: A Step Towards a Total Quality Society"
10- "Solving Problems in Education Using Quality Tools"
11- "Making Online Education Effective"
12- "Integration: The Key to Effective and Efficient Quality Education"
13 "Examining the Nexus of Workforce Development and Quality"

1. Introduction

When it comes to methods for stimulating creative thinking and innovative ideas, the old Chinese saying that there are many mountains up to heaven and many pathways up each mountain provides us with an instructive metaphor.

In an early significant and systematic study of creative thinking and innovation published in 1941, Austin Porterfield focused on what he called "flashes of insight" – those rare moments of discovery and recognition that will change the way that everyone will understand a concept or technology. (1) These flashes of insight transform our awareness and technical understanding as major breakthroughs, which ironically are so profound that most of these discoveries make what was previously unknown now seem blindingly obvious, so that over time creative ideas and innovations may appear quite mundane. How could we ever not have known about telephones, penicillin, and splitting the atom?

As a discipline, quality is the study of change. Early quality thought leaders, such as Walter Shewhart, focused their work on understanding the nature of change and were greatly influenced by thinkers such as Alfred North Whitehead who noted that progress is the art of knowing which changes to resist and which changes to promote. (2)

The body of knowledge for quality can be organized around the various methodological approaches to change with four major categories of study:

How to anticipate and prevent unwanted change;
How to diagnose and correct unwanted change when it occurs;
How to initiate and support change that improves processes and systems; and
How to achieve radical change that redefines knowledge and understanding through flashes of insight.

As a discipline, Quality deals with how we recognized, study, measure, prevent, control, stimulate, and create change and this White Paper will focus on how we achieve flashes of insight that create significant change.

Change is all around us, as the Greek philosopher Heraclitus observed. However, through our use of language, we diffuse our recognition of change. We employ words that seek to interpret change as either positive, negative, or benign, often causing us to overlook the basic reality that something has indeed changed. Products and services are allegedly improved, upgraded, enhanced, and renewed, we

are led to believe, so we are meant to see these changes as positive. If we are not supposed to like the change, then things have been downgraded, eroded, messed up, and any one of a dozen more colorful expressions. So, much of our discussion of change may be about the interpretation or "spin" that people want to put on change.

2. The Study of Innovation

The study of innovation, invention, creativity, and insight is an important field that undergirds a great deal of contemporary science and technology. It may be fair to consider that the organized study of innovation began in Germany with John Beckman, whose A History of Inventions was translated into English in 1846. O.T. Martin's Origins of Invention appeared in London in 1895. U.S. Patent Examiner, Joseph Rossman, surveyed 714 inventors and reported on a seven-step process for innovation in 1926. Similarly, R. A. Baker and Washington Platt interviewed 1.450 inventors to understand their inventive processes and published their work in 1931. S. C. Gilfillan summarized 35 "sources of invention" in his 1935 book, The Sociology of Invention. Alex Osborn's work on brainstorming in the 1930's and Austin Porterfield's Creative Factors in Scientific Research, published in 1941, both provided advancements in the study of creative thinking.

A review of the literature on how we achieve "flashes of insight" and develop new ideas suggests that there are many pathways to consider in how we develop ideas and innovation. There are also important lessons to be learned along the way as to why people ignore, resist, and refuse to accept new insights, which has been a subject of discussion among early quality thought leaders. Pathways to flashes of insight can include:

1. Recognizing significance in the mundane and mistakes.
2. Wondering, tinkering, and asking why or why not.
3. Systematic study based on a hypothesis and testing.
4. Brainstorming.
5. Synectic Methods.
6. Use of Creative Principles.

3. The Archimedes Moment

Porterfield relates how the story of Archimedes may be the original story of a "flash of insight" in western history. As an inventor working for the King of the Greek colony of Syracuse, Archimedes' work was revered among the Greeks and carried all the way to India by Alexander the Great, where Hindu thinkers kept his knowledge alive and passed it back through the mathematicians of Arabia to Spain and

then back into Europe after the "Dark Ages" in the west. This transmission of knowledge regarding Archimedes offers a powerful example of the transference of ideas across time and distance that the British historian, Sir Arnold Toynbee, referred to as "cultural radiation." (3)

Archimedes was pondering how to answer a question posed by his benefactor, King Hiero, as to how he might tell whether the gold in the King's crown had been adulterated with other metals. As Archimedes lowered himself into a tub of water for a bath, he saw the water rising in the tub and had the "flash of insight" in how to answer the King's question. The story goes that he cried "Eureka" (I have found it!) and ran out dripping wet into the street, having seen how he could compare the water displaced by the crown with water displaced by a measured quantity of gold known to be pure. It was certainly a breakthrough in the science of measurement.

Many people had undoubtedly lowered themselves into bathtubs and observed the water rising before Archimedes, but it was Archimedes who recognized the implication of what he observed. This is an important point, according to Porterfield, because flashes of insight often come from seeing something that many other people have seen before, but they did not realize the significance of what they had seen. (4)

4. Recognizing Significance in the Mundane and Mistakes

Many of the most significant flashes of insight that have changed human history have come about as people have observed mundane events or have had the ability to obtain insights from mistakes, failures and accidents.

Thomas Edison experienced just such a flash of insight when examining some previously used equipment and recognized that these used and mundane devices could be harnessed to create the phonograph in 1877. (5)

Alexander Graham Bell, a specialist in speech therapy, was conducting experiments to enable the transmission of multiple messages via a telegraph wire when, quite by accident, he produced the capability to transmit a voice over the wire and had the flash of insight to realize the significance of what he had done. (6) He then followed up on his chance discovery with systematic testing to enable his discover to work on a practical level.

Similarly, the discovery of penicillin and vulcanized rubber were both the results of flashes of insights

in recognizing the significance of failures and accidents, as someone asked, "What have we here?" By the early 1900's, academics who study the psychology of science were beginning to recognize the importance of flashes of insight by which individuals were finding discoveries by seeing the mundane in new ways and by being open to perceiving opportunities in mistakes and failures.

5. Wondering, Tinkering and Asking Why and Why Not

Flashes of insight also come about from simply wondering, or unsystematic tinkering, or just asking why we do things this way and why don't we do them another way. There are many pathways up this particular mountain. Robert Fulton's steamboat propulsion, Eli Whitney's cotton gin, and Thomas Blanchard's lathe all appear to be significant examples of this type of flash of insight. Porterfield observed that we usually fail to ask why or why not because most of us drift along with a "glassy eyed" acceptance of the world around us. (7)

Over time, a significant amount of change has come about from simply asking why things are being done the way they are, and why we should not adjust something. One can and should make the case that tinkering can be made systematic and more productive through the use of the quality methods. The systematic use of quality methods has provided a cornucopia of change in every discipline where these methods have been applied. The quality methods also helped people begin to understand the adverse impact of over-adjusting processes with the insights by Shewhart into the distinction between variation that is built into a process and that which is introduced as a special cause. (8)

6. The Hypothesis and Testing

The scientific method of developing and testing a hypothesis is a major source of innovation and discovery which emerged in 17th century Europe partly as a response to discovering the technical superiority of China, from which Europeans had learned about paper, printing, porcelain, silk, gunpowder, and many agricultural products. The scientific method builds an increasing body of knowledge about the world around us – and this knowledge is now growing so fast that it requires the constant creation of new specialized fields for people of study. Knowledge and information that has been gleaned through rigorous testing may offer immediate flashes of insight. But in some cases, the greatest potential for insight comes about in our ability to take new knowledge from one field, such as the study of the structure of a butterfly's wing, and apply it to another field, such as the optimum way to construct the surface of a solar energy panel. All fields of knowledge are potentially interconnected when it comes to innovation. Indeed, Buckminster Fuller celebrated the global expansion of human discovery through the scientific method but observed that over-specialization could lead humanity to

extinction and that we need to purposely create opportunities for knowledge to cross disciplines. (9) There are many pathways up this particular mountain.

As Porterfield observed the nature of flashes of insight, he referenced the observation made by Karl Pearson that "insights without data, without background, may be fantastic – in short, not insights at all, but illusions." (10) Porterfield found that creative observations lead to the development of hypotheses which can then be tested through experimentation, observation by sampling, or observation by sympathetic imagination. (11) The scientific method often answers the "why" and "why not" questions and provides facts for analysis, with the hope that the researcher has the vision to fully recognize the potential significance of the facts even when the initial results of an experiment are viewed as a failure.

7. Brainstorming

Brainstorming was developed by Alex Osborn in the 1930's as a way to increase the generation of ideas for employee suggestion systems. (12) As Osborn noted, the first "full-fledged" suggestion system in the United States was installed by the U.S. Navy in 1918 as part of the war effort and was modeled on an approach used at the William Denny shipyards in Scotland.

Osborn wrote about a variety of approaches to stimulating creative thinking – such as rearrangement, reversal, and combination of ideas which later appear in the analysis of creativity by Geinrich Altshullar. But, Osborn was most noted for this effort for "using the brain to storm a creative problem – and to do so in commando fashion, with each stormer audaciously attacking the same objective." (13) It should be noted that using a small number of soldiers to storm a position was a new French tactic that had replaced the massive phalanx of soldiers used so ineffectively in the first years of the First World War, hence the terms storm troopers and brainstorming.

Osborn's brainstorming was quite original in its requirement for a two step process with idea generation and idea evaluation being separate and having absolutely no critiquing of ideas during the idea generation phase and strictly observing a pause or waiting period between the generation step and the evaluation of ideas. Unfortunately, practitioners sometimes undermine Osborn's process by critiquing ideas as they emerge, defeating the process by discouraging participants from feeling free to generate ideas. Osborn must be credited with recognizing the fragility of a new insight which should not be prematurely discarded since this will lead to self-censorship.

8. Synectic Methods

In the 1940's and 1950's, researches from Harvard University and MIT initiated a major study of creative thinking and innovation, using the term "synectic," derived from the Greek meaning the connection of many things that may appear unrelated. (14) Under the leadership of psychologist, Dr. William Gordon, the Cambridge Synectics Group brought together a dozen top researchers from academe and the private sector and provided much of the foundation for subsequent publications (in both the professional and popular press) on how to stimulate flashes of insight.

Through a number of research studies, the synectics project revealed the importance of play in creativity and the value of tolerance for information that may appear irrelevant. This Harvard team focused heavily on the highly beneficial use of metaphors to create new ideas and introduced the need to make that which is familiar seem strange which became popularized as "thinking outside the box." The point is to shake us out of the condition Porterfield had observed as being "glassey eyed" and which the Russian inventor of TRIZ, Geinrich Altshullar, would later call "psychological inertia." (15)

One of the most prolific popularizers of the research related to synectics was Edward de Bono, a physician from the island of Malta. His first book, New Think, in 1967, contrasts vertical thinking (digging the same hole deeper) with lateral thinking (digging a hole in another place). (16) Although he did not credit his information to the many sources he must have used, de Bono did cover a wide variety of activities in his "new think" including looking at situations at random for inspiration, appreciating the role of chance and knowing when you have been lucky, and the usefulness of play in generating ideas, popularizing what the Harvard researchers had found.

Over time, de Bono continued to observe the ongoing research into creative thinking and incorporated the emerging understanding of metacognition through his insightful metaphor of consciously putting on and taking off hats which represent different approaches to thinking – the Six Hat theory. Many of the Cambridge Synectics Group findings subsequently have appeared in dozens of other books on creativity and innovation in the popular press.

9. Organized Creative Principles (TRIZ)

No review of methods that lead to flashes of insight can be complete without reflecting on the work of Geinrich Altshullar known as the Theory of Inventive Problem Solving. Like others before him, Altshullar recognized that there was much knowledge about generating ideas that could be gleaned from the study of patents. Through lengthy and systematic analysis of patents, Altshullar developed a list of 42 types of ideas upon which innovations are based and identified these as creative principles.

(17) This analysis significantly expanded the categorization of sources of creative ideas that had been offered by Osborn.

Altshullar showed that we do not have to sit back and wait for chance to create an Archimedes moment, and we do not necessarily have to test and disprove thousands of possible alternatives to a hypothesis, or only glean through accidents and mistakes, but that we can proactively and purposively draw upon well-defined creative principles to generate ideas.

The Theory of Inventive Problem Solving (known by the abbreviation TRIZ from the Russian) should be an area of study for all quality professionals as part of their professional understanding of change. Information can be found from triz.com and from sources within ASQ. (18)

10. Quality Embraces Innovation

The quality discipline has served for many years as a major source for organizing and teaching methodologies related to generating flashes of insight. For example, Bob King, who Dr. Deming referenced in his writings, became a champion of studying innovation and advocated for the use of TRIZ (along with Dr. Ellen Domb) to generate solutions to problems brought to the surface by investigations into quality failures and opportunities brought forward by continuous quality improvement methods. Working with the German quality expert, Dr. Helmut Schlicksupp, King organized an excellent handbook on innovative thinking for quality practitioners in the late 1990s that weaves quality and creative thinking methods together. (19)

11. Resistance to Change

Not everyone welcomes the ground breaking revelations from a flash of insight or even the small steps forward brought about through continuous improvement. New revelations disrupt comfortable assumptions and threaten the established order. Flashes of insight can lead to change that some will find desirable and some will resist because it erodes their influence and power within organizations and societies.

Pope Urban, for example, reportedly refused to look through Galileo's telescope, not wanting to have his comfortable beliefs that the Earth was the center of the solar system challenged. Galileo was forced to recant his view of the solar system despite what the evidence plainly revealed.

When reports of Alexander Graham Bell's discovery of conveying the voice over wire began to

circulate in England, it was reported as “the latest American humbug,” even though Bell was born in Scotland and was a Canadian. In the United States, the head of Western Union Telegraph dismissed Bell’s invention as a toy and passed on the initial opportunity to purchase it. (20)

As noted earlier, Porterfield observed that most people look at their surroundings with “glassy eyed” acceptance and offered observations as to how people could overcome this state. A great deal of the research and analysis in synectics by Gordon and the Cambridge Synectics Group considered how people tended to easily accept the status quo of information, technology, and beliefs. In his popular summary of creative thinking research, de Bono referred to the “arrogance of vertical thinking.” Altshullar framed this phenomenon as the need to overcome “psychological inertia.” This “glassey eyed” acceptance and “psychological inertia” comprises “the box” which we struggle to get out of when we talk about thinking outside the box.

All of these conditions fall within the discipline of quality, since they deal with change and quality, as a discipline, is the study of change. Quality professionals are keenly interested in understanding what causes resistance to beneficial change, just as they are interested in preventing unbeneficial or harmful change from impacting processes and systems.

Dr. Joseph Juran offered significant observations about overcoming resistance to change by noting that most people do not resist a proposed idea or a change on its own, but resist the social consequences of change. Technical change can have social consequences that include potential changes in control of information, elimination of existing jobs, the requirement to learn new skills, and changes in influence and authority within an organization or society. It is these implications of change, Juran observed, that create resistance to change. (21) And when a potential change threatens the status quo, some will resist the change by attacking not only the new idea, but the individuals who propose the new idea, meaning that being a change agent can be a costly role to play.

Since a flash of insight or a refinement from a Six Sigma project might introduce a change that could unsettle the stability of a system and might generate resistance to change, the planning for the introduction of change often benefits from using a gestalt, or systems approach. The use of a force-field analysis, as advocated by Kurt Lewin, encourages the quality practitioner to identify, analyze, and create strategies regarding the forces in a system that may support or resist change. (22)

Imagination, innovation, and flashes of insight can and do change the world and the change will benefit some while it may have an adverse impact on others as individuals, communities, and societies

as a whole.

12. How Change Re-Writes History

The general public often perceives history as being a well – defined set of established facts that everyone should be able to agree upon. Everyone can agree that there was an American Revolution and a Civil War, along with two World Wars in the last century. But what caused these events to happen is the subject of analysis and re-thinking over the years. This re-examination of the past is problematic for those who have never formally studied historiography and want their history to be neat and simple. History buffs enjoy reading history. Historians study the past and analyze it.

The French philosopher, Henri Bergson, offered an understanding as to why each generation will re-analyze the history of everything that has gone before it. (23) Each generation confronts a set of problems and will re-examine the past to understand the causes of the problems of today. What may have been insignificant during the lifetime in which people lived a hundred years ago, and which may have escaped the attention of historians 50 years ago, can become very important today as we seek to understand how actions in the past have influenced the present, as we now experience it.

A ground-breaking discovery may go unnoticed during the lifetime of the individual who made the discovery. Innovative thinkers may live for decades before their contribution impacts the world and is recognized by others.

13. Quality as the Study of Change

Change requires us to re-think everything, including the nature of a discipline, such as quality. As we reflect on the foundational work in the quality discipline, we may find that the discipline began with an emphasis on preventing unwanted change (quality control) and understanding how variation (which is change) may be built into a process or introduced by actions. Our thinking expanded into developing systematic approaches (which we call problem solving) to help us identify the causes of unwanted change when they are unknown to us. Our examination of change has expanded into the methods of root cause analysis to help us understand the systemic issues that enabled changes to evolve or suddenly emerge. Likewise, we overcame the common wisdom of "if it is not broke, don't fix it" and developed methods and a concept of the desirability of continuously seeking to improve existing processes, which meant introducing desirable changes.

It is quite fitting then for the body of knowledge for quality to include the study and applications of

methods that introduce significant or even revolutionary change as yet another mountain up to heaven. The variety of creative thinking methods and approaches to innovation that create flashes of insight provide many pathways up this mountain.

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