

Turbocharge General Education Requirements with Science of External and Internal Excellence

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Pradeep B. Deshpande is Professor Emeritus and a Former Chair of the Chemical Engineering Department at the University of Louisville. He served on the ChE faculty there for thirty-three years (1975 – 2008). Post retirement, he has continued his research into the pursuit of perfection in human endeavors and teaching and consulting in advanced process control and six sigma. He is an author or co-author of more than 100 papers and eight books including the most recent, P. B. Deshpande, Roberto Z. Tantalean, and M. A. Bhalodia, *Process Control and Optimization* (estimated 2017), P. B. Deshpande, *Six Sigma for Karma Capitalism*, 2015 (amazon), and P. B. Deshpande, PhD and James P. Kowall, MD (Neurology, Internal medicine), PhD (Theoretical Physics), *The Nature of Ultimate Reality and How It Can Transform Our World: Evidence from Modern Physics; Wisdom of YODA*, 2015 (amazon) all published by his consulting firm Six Sigma and Advanced Controls, Inc. The latter two books are meant to serve as texts in the course(s) on the science of external and internal excellence. Pradeep is a recipient of several awards including Donald P. Eckman Award in Process Control Education given by ISA and is a Fellow and life Member of ISA. He has presented lectures on the topic in several countries including the Congress of one to enthusiastic audiences. He has introduced the science of internal excellence in his six sigma course of the MBA program of the University of Kentucky in Athens, Greece he has been teaching for ten years. Dr. Mikel Harry, co-creator of six sigma is fully on board (See, *Profound Implications of Minimum Variance Control* on his online blog, *Business Improvement Times*) as are three recipients of the second highest civilian award given by the Government of India, two of whom are also Fellows of the Royal Society and one is a recipient of the President's National Medal of Science together with a renowned quantum physicist and former presidential nominee.

Turbocharge General Education Requirements with Science of External & Internal Excellence: A Proposal

abstract

This proposal seeks to add two new topics, Science of External Excellence and Science and Practices of Internal Excellence to the General Education Requirements arguing that doing so will make the education of college students whole and complete. The rationale for the what, why, and how of this proposal is presented along with some ideas on how the efficacy of the proposed approach can be audited. The students will derive a myriad of benefits from embracing the ideas and concepts in the course which include health and wellness, exemplary performance in all walks of life, creativity and innovativeness, better leadership decisions, interpersonal skills, and less discord and violence. The paper makes a case for how such a course has the potential to transform higher education and is, therefore, worthy of consideration by the US higher education community.

background

Engineering students opt for the discipline of their choice for an in-depth understanding of their chosen major but all university students are generally required to take a certain number and types of courses to meet the general education requirements whose purpose is to make their education whole and complete. Four decades of academic and industrial experience and emerging evidence suggests that there is a further scope in making the education of students whole and complete by adding two new subjects to the general education requirements: scientific framework for external excellence and scientific framework for internal excellence. These topics teach students: (1) How to do all that they do in life in the best possible manner (science of external excellence) and (2) How to be their internal best (science and practices of internal excellence). The introduction of topic (2) is important because in the absence of an adequate level of internal excellence, external excellence programs including the best of the best quality initiatives, fall short of expectations. Therefore, it is important to embrace both. It is essential that these topics are taught in colleges as today's students are tomorrow's leaders, thinkers, movers, and shakers of the world. This article presents the what, why, and how of this assertion suggesting that these topics have the potential to transform higher education.

scientific framework for external excellence [1]

External excellence refers to the ability to do all that we do in the best possible manner. The various activities of life and commerce fall in two categories: static and dynamic. Dynamic processes are typically encountered in manufacturing while static processes are

found in both, manufacturing and non-manufacturing environments. The desire to operate these processes in the best possible manner translates into the pursuit for minimum variance [2]. To elaborate, when work of any kind is done, one or more outcomes are generated by which its performance may be assessed. Typical outcomes of general interest are (1) cycle times - time to complete a task, (2) specific attribute(s) of quality, and (3) costs incurred in performing the task. Science demands that the results of an experiment be repeatable and reproducible and that is the way it should be. Engineers, on the other hand, recognize that the outcomes of processes and transactions exhibit a certain amount of inherent variation no matter how well they are designed and operated owing to certain causes that are unknown or uncontrollable. Statisticians refer to these causes as common causes and such a state as the natural state. The common cause variability considerations preclude the possibility of zero defects ad infinitum. This inherent, unavoidable variation in the outcomes of processes is worsened by measurement errors and by other causes that are identifiable. Discovering and then fixing these causes returns the process outcome to its natural state. Engineers have taken this to be the state of true minimum variance, as had the author until several years ago. These ideas are explained in Figure 1.

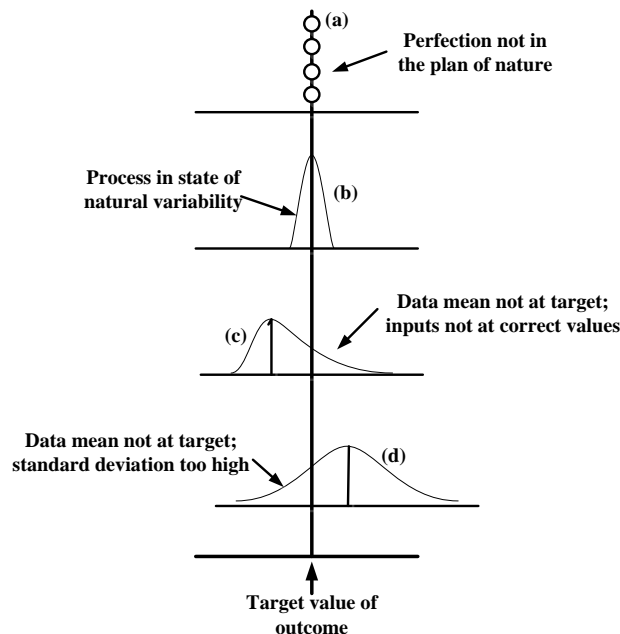


Figure 1. Returning the Process Outcome to its Natural State

Some engineering disciplines, chemical engineering, mechanical engineering, and electrical engineering among them, deal with dynamic processes where the students learn how to strive for minimum variance with a computer-based advanced control strategy, which in chemical engineering, goes by the name constrained model predictive control (CMPC). Developed in the late seventies in industry, CMPC remains the state of art in the process industries till today. Now, static processes in life and commerce vastly outnumber

dynamic processes, perhaps by as much as 9:1 and, therefore, it is essential to teach engineering students, in fact, all students the wherewithal of how to achieve the best possible performance of static processes.

Fundamental, mechanistic approaches to problem-solving should always be preferred but, when sufficiently detailed knowledge of the process or transaction is unavailable, as is often the case with modern-day processes and transactions, systemic or data-driven approaches have to be used. In the late seventies, Motorola unveiled one such approach and called it six sigma. It was co-created by the late Bill Smith and Mikel J. Harry under the leadership of CEO Bab Gavin at a time when the annual company revenues had plummeted to \$2 billion. Several years after its implementation, the company revenues reportedly jumped to \$8 billion and Motorola received the inaugural Malcolm Baldrige National Quality Award from President Reagan in 1988 [3].

Briefly, six sigma is a structured, disciplined, and data-driven approach to problem-solving based on input-output data that doubles up as a top-notch quality initiative for operating static processes and transactions in the best possible manner. In the present context, however, it is prudent to think of six sigma as the former to avoid an unhelpful debate as to which quality initiative is better. Whatever be the quality initiative, the aim is always the same: the pursuit of minimum variance. The phrase *six sigma* also denotes a specific performance measure: 3.45 defects per million opportunities for a process outcome with a single-sided specification. Six sigma is implemented with the help of five phases, which in turn are composed of eleven steps. They are tabulated in Table I. Defects arise because the process or transaction is not designed well or is not operated well. For a well-designed existing process, defects arise because a six sigma-like program is not in place or that some of the steps of the six sigma methodology are missing/mishandled. Reference [4] outlines a proposal on introducing a six sigma course in ChE curricula [4].

understanding internal excellence [5]

It is necessary to grasp the notion of internal excellence to appreciate its criticality in external excellence programs such as six sigma. To elaborate, each of the 7 billion human inhabitants of Earth have three components of the mindset in specific proportions. These components are explained in Table II and Figure 2. Now, humans are endowed with two emotions: positive emotions and negative emotions. The **S** component of the mindset strongly and positively correlates with positive emotions, while excessive **R** and **T** components strongly and positively correlate with negative emotions. The definition of the three components is such that it precludes the possibility of a human being possessing only the **S** component, or, for that matter, only the **T** component and so perfection is not possible here either. The three components and the two emotions lead to two equivalent

Table I. Six Sigma Phases and Steps

Phase	Steps	Description
I. Scope	1	Articulate the problem statement.
	2	Define the response variable (outcome(s)).
	3	State the project goal.
II. Measure	4	Draw a process map.
	5	Validate the measurement systems.
	6	Collect data on the response variable(s).
	7	Establish the baseline (starting defect levels).
III. Analyze	8	Design and conduct experiments and collect data on the response variables and potential causes of variability in the response variable.
	9	Analyze the data and identify major impact factors and trivial many factors.
IV. Improve	10	Set the major impact factors at optimal levels and run experiments to confirm benefits.
V. Control	11	Monitor the response variables and impact factors to insure problems once fixed stay fixed and benefits are sustained.

Table II. Mindset Components and Emotions

Mindset Component	Description
S	Truthfulness, honesty, steadfastness, equanimity
R	Attachment, ambition, bravery, ego, greed, desire to live
T	Lying, cheating, causing injury in words or deeds, sleep
Emotion	
Positive Emotions	Unconditional love, kindness, empathy, compassion
Negative Emotions	Anger, hatred, hostility, resentment, frustration, sorrow, guilt, jealousy, despair
Correlations	Positive emotions are strongly and positively correlated with the S component. Negative emotions are strongly and positively correlated with excessive R and T components.

scales of internal excellence and emotional excellence depicted in Figure 2. The noble ones are toward the top-end of the scales while the wicked ones toward the bottom, and the rest of us somewhere in between. The purpose of life should be to rise on these scales

of excellence along with everything else we do. Failure to do so has a negative impact on ourselves and everything we do in life.

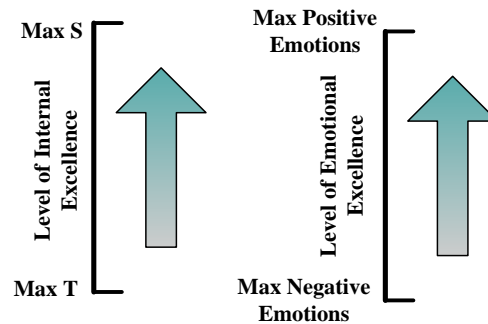


Figure 2. Two Equivalent Scales of Internal Excellence

For reasons whose fundamentals are not clear, the **S**, **R**, **T** components undergo transformation over time inducing the rise and decline of societies. As the average **S** component of a society rises, the society rises, but the **S** component cannot rise indefinitely, and, so, when it reaches its peak, the **T** component takes over and the society begins to decline. The **T** component cannot rise indefinitely either, and, so, when it reaches its peak, the **S** component takes over and the society begins to rise again and so on. Figure 3(a) depicts the phenomena. Historical data bears testimony to the efficacy of these assertions. The author had collaborated with a Greek-American friend and colleague in the early nineties who had compiled the list of individuals born in Greece listed in all 23 volumes of the Encyclopedia Britannica, which clearly showed the rise and decline of Greece more than two thousand years ago [6]. Figure 3(b) depicts that data in graphic format. Similar data for England, Germany, and the United States are available. The phenomena of rise and decline are natural and as such cannot be avoided and therefore, global peace ad infinitum is not possible. However, with the scientific framework of external and internal excellence, it should be possible for developed nations to keep their decline at bay longer, change the direction of nations presently in decline, and accelerate the rise of emerging nations to make this a better and more peaceful world.

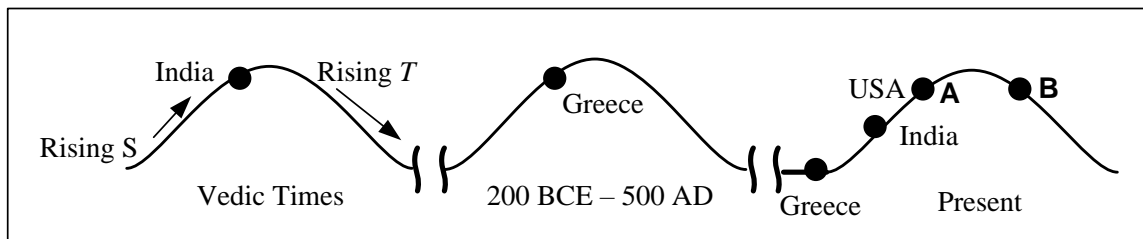


Figure 3(a). Mindset Transformations Induce Rise and Decline of Societies

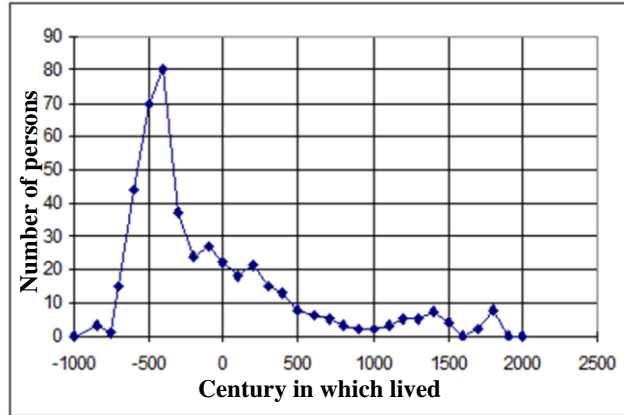
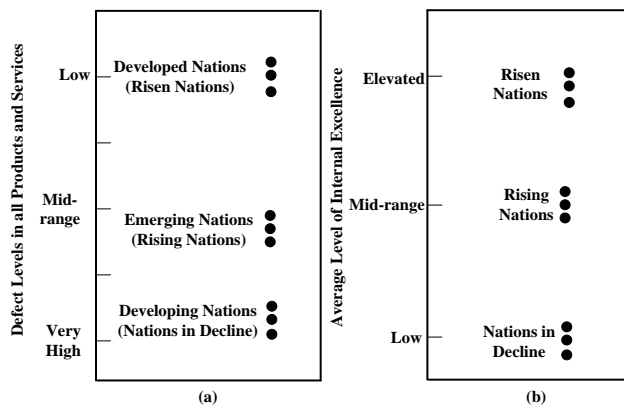


Figure 3(b) Rise and Decline of Greece

criticality of internal excellence in external excellence programs [5]

In 2004, the Times of India quoted Dr. Mikel Harry as urging India to use six sigma to catch up with the world [7]. Until several years ago, the author too was absolutely convinced six sigma was sufficient to change the world for the better [8] but he has since learned that six sigma is necessary but not sufficient for exemplary performance. To elaborate, Figure 4(a) depicts a qualitative plot of defects in all products and services for developing, emerging, and developed nations. The only way developing and emerging nations can substantially improve themselves is by dramatically reducing the defect levels in all their processes and transactions. Developed nations, too, can ill afford to become complacent or else their defect levels are sure to rise. Given that six sigma is an appropriate framework for reducing the defect levels in all processes and transactions and the list includes dynamic processes, nations really have no choice but to embrace six sigma-like strategies if their aspirations to evolve into better societies are to be fulfilled. The author had shown some time ago that CMPC was a six sigma strategy for dynamic processes [9].



**Figure 4. (a) Defects vs. Nations (Left)
(b) Internal Excellence vs. Nations (Right)**

There are many impressive examples of six sigma. Pioneering among them is what Motorola achieved in the late seventies and early eighties. General Electric Company, under the stewardship of Jack Welch, Jr., himself a PhD chemical engineer, demonstrated tremendous business success with six sigma in the late-nineties, also showing that six sigma could be successfully applied across diverse businesses (GE Capital, Appliances, Aircraft Engines, Medical Systems, Plastics, and Lighting). At the time, most of the 300,000 GE staff had undergone some six sigma training.

Even more impressive is the case of Mumbai's 5,000 lunchbox delivery-boys (called Dabbawalas) who deliver 200,000 lunch boxes a day generating only 1 defect in 6 million deliveries according to Forbes. What is remarkable is that these men are semiliterate and have no clue what statistics is. So impressed was Britain's Prince Charles that he paid a visit to Mumbai on November 5, 2003 to witness the Dabbawalas at work whose leaders were subsequently invited to the royal wedding. In the wee hours of the following morning in Louisville, the author had excitedly explained to BBC listeners in Britain how the Dabbawalas' was a six sigma operation [10]. It is obvious the author had no idea at the time how important internal excellence was in the pursuit of external excellence.

The answer came on the weekend of March 2-3, 2013. Sitting in the British Airways Business-Class Lounge at London's Heathrow Airport Terminal 5, the author happened to come across Victor Mallet's column in the Financial Times, "*Kumbh Mela's Pop up Mega City is a Lesson in Logistics for India*" [11]. In the article, the correspondent reported that the Kumbh religious festival attracts tens of millions of devotees to the city of Allahabad on the banks of the Ganges every twelve years. In 2013, the festival attracted anywhere between 30 million to 100 million visitors by various estimates over a two-month period. The state Government of Uttar Pradesh built temporary housing for these teeming millions, which Mallet referred to as a "Pop up mega city" to be torn down after the festival (Figure 5). What the reporter found striking was that the defect levels (roads, food-supply, electricity, water, sanitation, lighting, clinics, etc.) in the tent city were exceptionally low, as though it were in a developed nation, but, by contrast, they were astronomically high in the city of Allahabad or, for that matter, in the state of Uttar Pradesh. So impressed was the former Chief of the World Bank that he took a dip in the Ganges himself. Mallet cited a specific example of high defect levels in the surrounding city and the state: The World Bank had given the state of Uttar Pradesh a multiyear loan to build toilets in the state. The annual reports showed a rising number of toilets constructed year after year, but an audit at the end of the project period showed that very few toilets had actually been built! On the flip side, when asked to explain how they had been able to achieve such exemplary performance in the mega city, the official in-charge of the project explained that they were careful in workforce-selection and the workforce



Figure 5. Pop up Megacity at Kumbh Festival, January–February 2013

was very aware of the sacred nature of their work; the facility was for the devotees. This was an aha moment for the author. It became clear that the relatively high level of internal excellence of the folks associated with the mega city, workers and devotees included, was the major reason for exemplary performance in the mega city, and the relatively low level of internal excellence in the city of Allahabad and the state of Uttar Pradesh were responsible for the high defect levels. Not long ago, the author also came to know about the high level of internal excellence of the Dabbawalas from a Newspaper article [12]. So, the six sigma process of the Dabbawalas was only partially responsible for their exemplary performance, the high level of internal excellence contributed to their success as well. The bottom-line is this: *What six sigma considers as minimum variance is really not the true minimum variance state and therefore, further improvement in performance is possible by increasing the level of internal excellence.* These findings are reflected in Figure 6, and they have profound implications for a better and a more peaceful world. The findings also suggest that engineers are in a unique position to make a substantial contribution in this endeavor. Figure 4 (b) will now provide a fresh perspective on why the defect levels in developing and emerging nations are much higher than they are in developed nations.

Scientific Framework of Internal Excellence [5]

The scientific framework for internal excellence presents the wherewithal of how to become endowed with abundant positive emotions at the exclusion of negative emotions which in turn means a rise in the level of internal excellence. The framework is founded on ancient Eastern wisdom recently corroborated by the experiments of Western scientists together with the author's own scrutiny of four decades. A synopsis of the framework may

be found online in the author's recent interview [13] and is detailed in the referenced book [5].

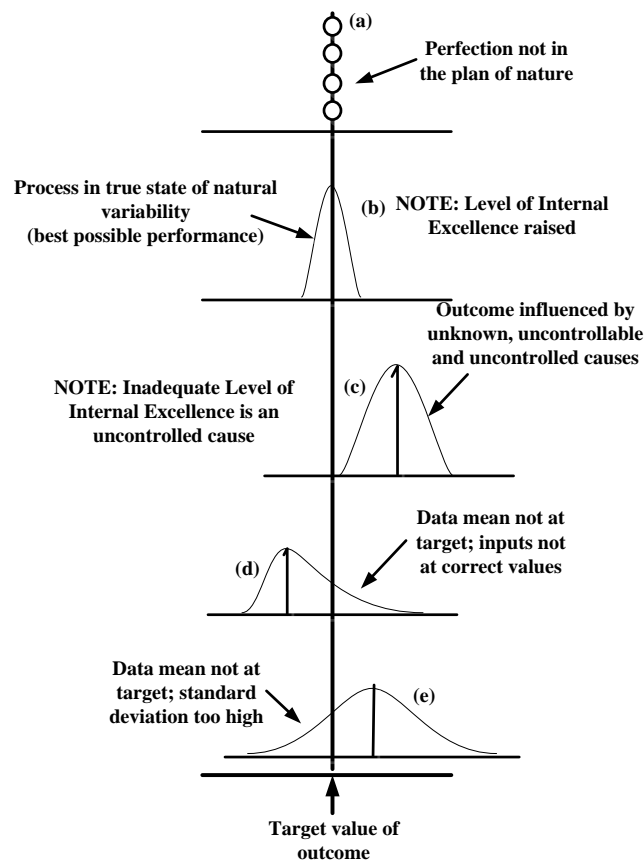


Figure 6. Pursuit of the State of True Minimum Variance

If internal excellence, or, equivalently, the emotional state is to be used as an outcome measure in a scientific project, it has to be measurable. There is no way to measure internal excellence directly but engineers know that under such circumstances, secondary, inferential measurements that are highly correlated with the primary unmeasurable outcome, can be used. Some inferential measures of internal excellence are: (1) capacity to remain centered in the face of extenuating external conditions that are part of life, (2) spontaneous affection shown by animals, birds, and butterflies, and (3) human bioenergy field.

One's capacity to remain centered in the face of extraordinary external conditions is amenable to self-assessment. Figure 7 depicts the link of the capacity to remain unaffected and the level of internal excellence. At lower levels of internal excellence, extenuating external conditions cause broad and long-lasting perturbations in the internal condition. As the level of internal excellence rises, the perturbations dampen and become short-lived. As a reminder, perfection is not possible here either, minimum variance is the best

achievable state. The videos at References [14] and [15] are dramatic illustrations of low and high levels of internal excellence.

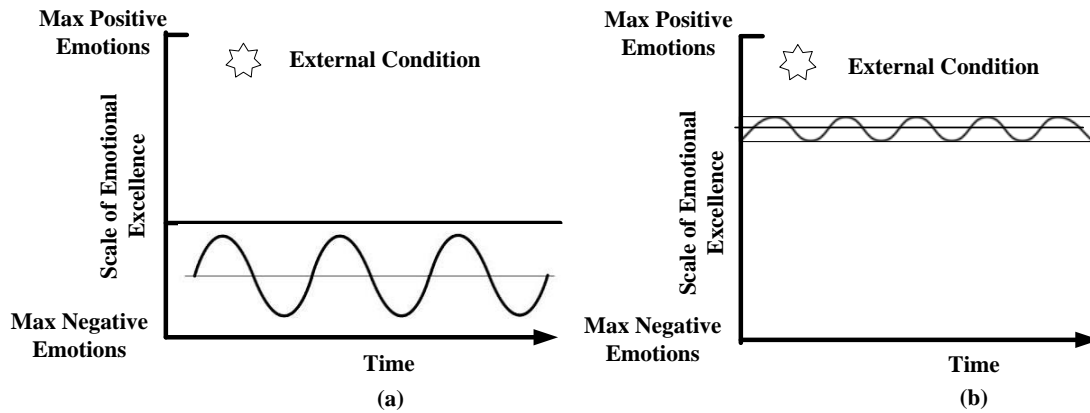


Figure 7. Influence of External Conditions on Internal Excellence

Thinking like an engineer, the next task is to find an inferential measurement of internal excellence so that it can be used in feedback control. In this context, human consciousness appears to have an awareness of emotions at its deepest levels even though there is no awareness in the ordinary sense of the word. As an illustration, Finish medical researchers recruited 700 volunteers for a study, roughly half of them from the Eastern cultures and half from the West, and gave them a blank silhouette (labeled Neutral in Figure 8(a)) and asked them to color specific emotions. To their amazement they discovered that definite patterns of colors emerged for different emotions as depicted in Figure 8(a). Their study was published in the Proceedings of the National Academy of Sciences-US [16].

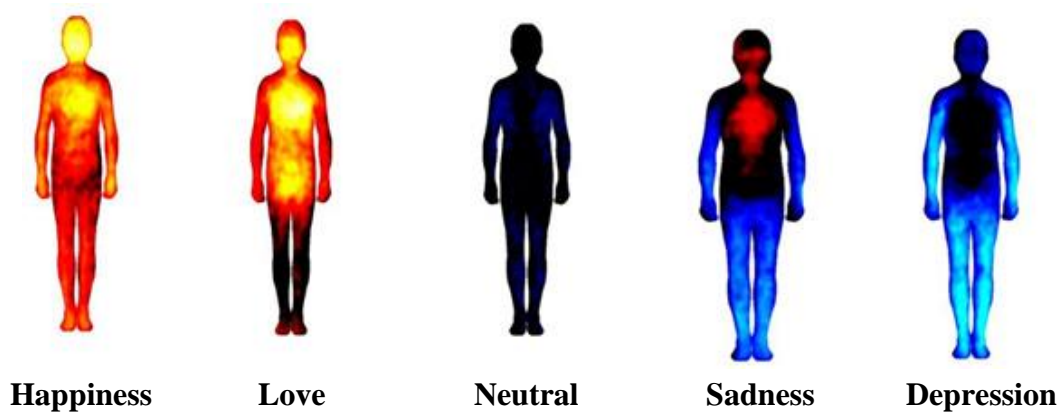


Figure 8(a). Seven Hundred Volunteers Color Different Emotions

Although generally unaware, human beings appear to emit signals continuously that are reflective of their emotional state. Finding a way to capture/measure them and correlate them to emotions will provide a feedback signal for regulating emotions. In this context, scientists, including the author, already had the evidence of emotions having an effect on

autonomic factors such as respiration rates, heart rates, and heart rate variability (HRV). An example of the influence of emotions on HRV is shown in Figure 8(b).

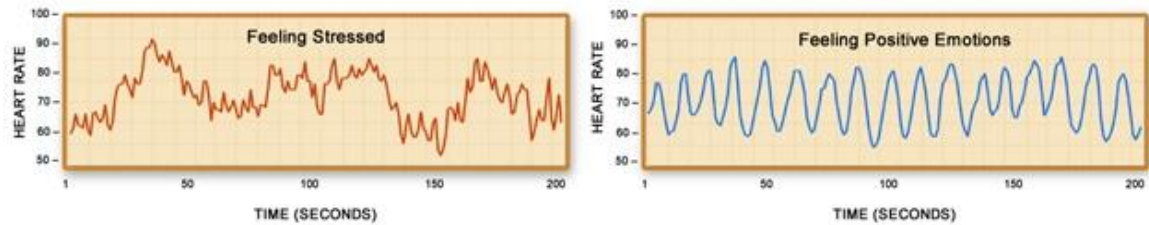


Figure 8(b) Effect of Emotions on Heart rate Variability
(Courtesy of Dr. Rollin McCraty, Institute for HeartMath, Boulder Creek, CA)

Recently, MIT electrical and computer engineering researchers have found a way to inferentially estimate emotions [17, 18]. With the support of the National Science Foundation, US Air Force, and major corporations, they developed a wireless device called EQ-Radio which transmits RF signals to the subject and captures and analyzes the reflected signals to estimate the respiration rate, heart rate, and beat-to-beat variations at an accuracy of 87%. From these data the emotional state of the subject is inferred.

The inferential measurement of choice in this proposal is the photonic signature of humans. The photonic signature of each of the 7 billion inhabitants of Earth is unique and is reflective of their physiological and psychoemotional state. The forty-six chromosomes inherited from the parents and the individual's own willful actions from adolescence to the current age contribute to the uniqueness of this signature. This signature can be inferred through the subject's bioenergy field. To elaborate, human beings have trillions of cells. If the cells are broken down further into smaller parts, they are made up of atoms which have protons and neutrons in their nuclei and electrons orbiting them. Atoms are not solid objects and, so, a question arises: what characteristics of an atom give the specific character to matter? For example, why is Gold, Gold? Or, why is Iron, Iron? The answer is: atomic configuration. Similarly, in the case of cells, the cellular configuration is what determines the cellular structure and in turn, whether a cell is healthy or not. The vibrational characteristics of the cells determine our physiological and psychoemotional state. Human vibrations can be thought of as light, not necessarily visible light, with unknown frequencies along the entire electromagnetic spectrum. Over fifteen years ago, Konstantin Korotkov, a Professor of Biophysics and Computers at the St. Petersburg Federal University in Russia, found a way to estimate this "light" with the help of the Gas Discharge Visualization (GDV) principle [19 – 23]. Here, the subject places his finger, one at a time, on the glass plate of the GDV device connected to a computer. The computer then gives a harmless electrical signal in the range of 11 KV for a millisecond. The finger's response to this stimulus is a burst of photons which are captured and analyzed on the computer. By comparing the data for tens of thousands of subjects,

correlations are presented which provide an estimate of the subject's physiological and psychoemotional state at a high confidence level. The method is completely painless, noninvasive, and takes only a couple of minutes to complete. The GDV device was approved in Russia by their Ministry of Health over fifteen years ago for use as a routine medical diagnostic device in Russian hospitals and doctor's offices. A workshop on GDV was organized at the National Institutes of Health in 2002 [24] but the device is not registered in the United States for any specific purpose. For the purpose of this work, the device may be thought of as a bioenergy device belonging to the area of Alternative and Complementary Health. Korotkov and his associates Madappa and Orlov have used the GDV device with an Eco-sensor attachment for remote sensing of emotions [25].

The GDV device provides an estimate of the overall energy of the subject in Joules and, also, an estimate of emotional stress, health status, energy reserve, Yin Yang, and the state of chakras from the Indian system of Ayurveda all in terms of energy. Briefly, there are seven chakras whose energy levels in Joules as indicated by their sizes together with their dis-alignment from the central vertical line as a percentage, determine their strength. The software specifies the target values for the chakra energies in terms of size and alignment (5 Joules and 100%, respectively). The farther away these parameters are from their targets, the more problematic is the physiological and psychoemotional state. Figure 9 depicts the chakra systems of a yogi and an unwell subject. Notice that chakras of the unwell subject are tiny corresponding to very low energy levels and are severely dis-aligned.

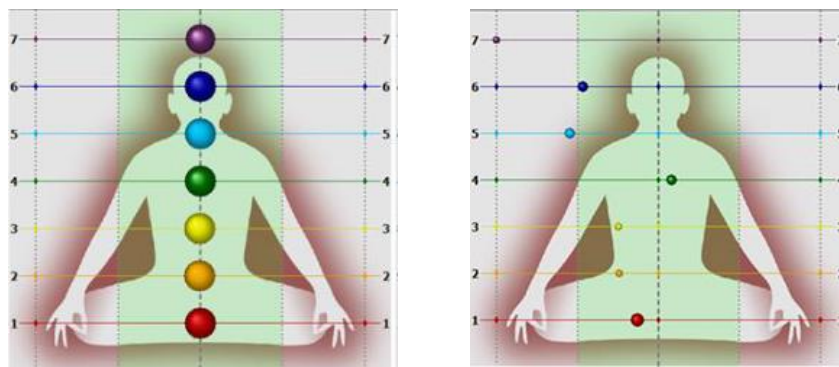


Figure 9 Chakra Systems of a Yogi and an Unwell Subject

Negative emotions significantly contribute to physiological problems, and, therefore, dis-balanced/small chakras are tell-tale signs of future health problems even though the current health status appears to be near normal. In this context, Nobel Laureate Elizabeth Blackburn discovered that high levels of stress cause the telomeres (protective caps on the chromosomes in the nuclei of cells) to dwindle leading to accelerated aging and all kinds of diseases. For this work she received the Nobel Prize in Physiology and Medicine in 2009. The American Medical Association says that eighty percent of diseases are caused

by high levels of stress. So concerned was Dr. Blackburn, she wrote a comment in Nature urging world Governments to heed the warning on stress [26 – 28]. Negative emotions lead to stress, positive emotions do not.

With the measurement device (GDV) on hand, a control problem can be formulated which seeks to raise the level of internal excellence. Selecting the chakra component of the GDV device as the outcome to focus on, there are fourteen outputs to regulate: seven average chakra sizes, Joules, and seven average chakra alignments, %. Associated with these fourteen outputs are fourteen standard deviations. The goal of optimization is to drive all fourteen outputs towards their targets while minimizing the fourteen standard deviations. There are two approaches for solving the problem: (1) conscious Approach, (2) a process whose side-effect is a rise in the level of internal excellence. In the first, the aspirant tracks his/her **S**, **R**, **T** components and, equivalently, the two emotions diligently to insure that the **S** component remains high and nudges higher and the **R & T** components remain low and nudge lower. A month-long self-assessment study will offer convincing evidence that the conscious approach is necessary but not sufficient. Yogis have known for millennia that the process whose side-effect is a rise in the level of internal excellence is meditation. Success with meditation requires a good physical body and, therefore, physical exercises for the joints, muscles, and spine and breathing exercises [29] for internal organs and systems are supportive of the effort. That said, no one knows why and how these benefits of meditation come about and how meditation changes us from within, but it certainly does. A constrained model predictive control scheme for regulating the chakra system is shown in Figure 10. In a sense, the scheme is bizarre in that, unlike routine manufacturing applications, here, the process and the controller are one and the same, namely us!

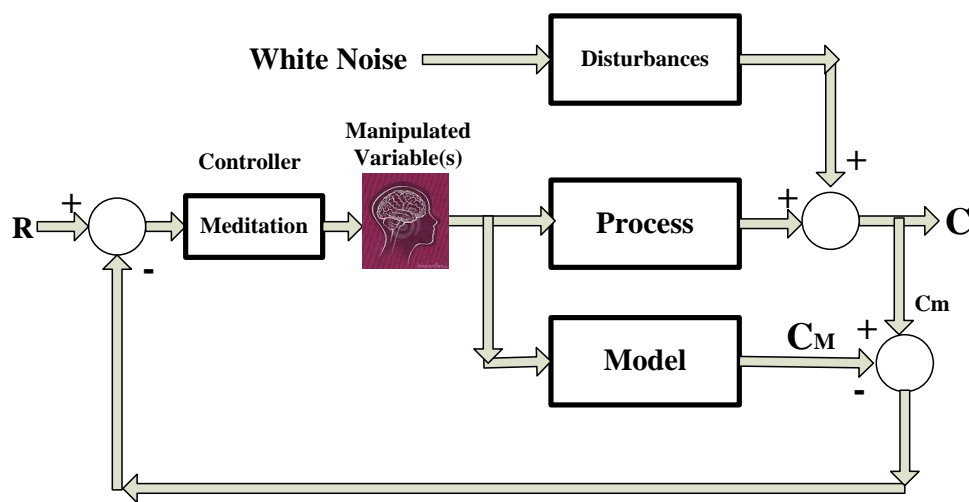


Figure 10. A Constrained Model Predictive Control System for Chakra Optimization

An interesting example of the success with meditation is the Chicago Cubs victory over the Cleveland Indians in 2016, ending a drought of 108 years. In the Time magazine article [30], How the Chicago Cubs Made World Series History, columnist Sean Gregory wrote: *"Epstein also set out to train his players' brain. The Cubs have a five-person mental skills team that offers mindfulness exercises, visualization drills, and meditation to all players throughout the organization. "The overriding philosophy is better humans make better players," says Josh Lifrak, who runs the program. Don't let the moment get too large. Catch yourself thinking bad, that's mindfulness. Not only knowledge, but action."*

In the language of the Science of Internal and External excellence, *"Catch yourself thinking bad, that's mindfulness"*, means conscious approaches to reining in the R, T components are necessary but not sufficient. The sufficiency condition is reached with meditation which the Cubs appear to have understood. Josh Lifrak even stated as though he had read the referenced works, *"better humans make better players"* which in the language of the scientific framework translates into, "better humans make better students, better engineers, better business leaders, better medical doctors, better political leaders, and so on", and a rise in internal excellence is the pathway to realize these objectives.

Another interesting example involves a speech by Prime Minister Narendra Modi of India on aura (light-energy) and meditation [31]. He also spoke on the subject at the 2014 Convocation of the All India Institute of Medical Sciences in New Delhi [32]. He mentioned that the aura which was barely 5 – 6 cm beyond his thumb, had expanded to a size larger than the washing machine-sized Kirlian Camera pursuant to the yoga program. He suggested that with continuing progress, aura science could become a significant input to medical science. It is clear that the program was working for him many years later going by the following information on Mr. Modi's maiden visit to the US as Prime Minister in 2014: *"While the first lady has been instrumental in introducing yoga inside the White House, Obama appeared to be very impressed by the energy and vigor shown by Modi when he hosted the latter over a private working dinner in the Blue Room of the White House on Monday. They joked about the fact that the rest were eating and the Prime Minister (Modi) was fasting (Nine-day fast that happened to coincide with his visit). The President expressed his admiration for the energy and vigor with which the Prime Minister was able to maintain this rigorous schedule on a diet of only warm water"*. At the prodding of the Prime Minister the United Nations designated June 21st as International Yoga Day in 2014. That resolution was supported by more than 175 countries. Now, if the nations were to develop an appreciation for yoga as a means to raise internal excellence, then, the world will surely be better and more peaceful.

By now, reputed science publications such as Nature, Science, and Proc. Nat. Acad. Sci.-US have carried full-length articles on meditation and medical publications have reported

on its health and wellness benefits. Business leaders too have reported on the financial benefits of meditation for their companies. The list of famous CEOs and Nobel Laureates who regularly meditate is long. The benefits of meditation include health and wellness, exemplary performance in all walks of life, better leadership decisions, creativity and innovativeness, and less discord and violence. More details may be found in [33 – 51].

The author has conducted extensive experimentation on himself for over a year to assess the efficacy of meditation in restoring the chakras towards their respective targets. Tables III(a) and III(b) present the results over a sixty-three day period in 2015-2016. Figure 11 presents some of the best results of meditation in graphic format. The results presented reveal that the overall energy as measured by the GDV device has gone up in the vast majority of the 63 measurements. The autonomic system (heart rate, respiration, burning of calories) is still at work in the course of meditation, and, so, the increase in measured overall energy must, necessarily, mean that the light-energy has gone up. The finger-energy images provided by the GDV also indicate an increase in light-energy. From a statistical and practical perspective, the efficacy of meditation in restoring the chakra system towards their respective targets is self-evident. However, in comparison with the results of the yogi in Figure 9, further progress is possible.

Table III(a). Average Performance of Meditation

Parameter	Before	After
Overall Energy, Joules	55.5	57.8
Chakra Alignment, %	89.7	92.9
Chakra Energy, Joules	4.5	4.78

Table II(b). Performance of Meditation

		Ave. Size			Alignment toward 100%			Energy	
Month	Up	Down	Same	Up	Down	Same	Up	Down	Same
Dec	15	1	0	11	3	2	14	1	1
Jan	11	4	0	9	6	0	8	4	3
Feb	15	1	0	12	3	1	12	1	3
Mar	14	2	0	13	1	2	13	1	2
Total	55	8	0	45	13	5	47	7	9

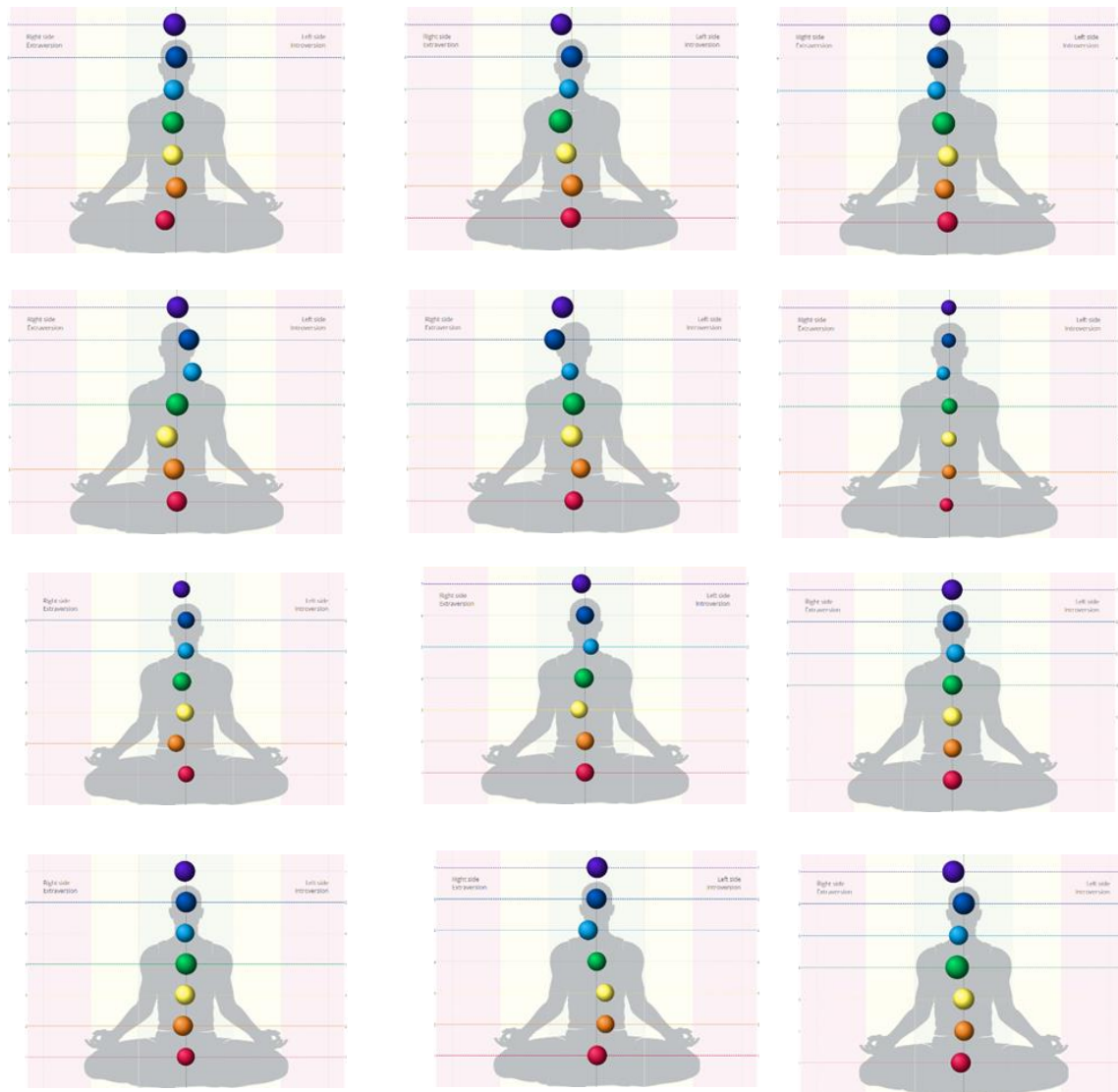


Figure 11. Some of the Best Results of Meditation

path forward

The author envisions one 4-credit course to cover the topics of science of external excellence and science and practices of internal excellence. Statistics should be a prerequisite for the course. The first semester of the third or final year appears to be suitable for the course, as that would give students sufficient time to experience the beneficial effects of meditation on the various aspects of their lives including academic performance. There must not be any religious overtones in the coverage of Internal Excellence.

For the six sigma portion of the course, there are many books available and the author has a book that has been specifically developed for use with the course on the Science of External Excellence [1]. Reference [5] is intended to serve as text for the course on the Science of Internal Excellence.

discussion

From a control engineering perspective, human beings are nonlinear, multivariable, self-regulating, and evolving as they age, each with a unique common cause variability that is inherited from their ancestors and by their own actions to the current age. Therefore, statistics is the proper branch of science to use for analysis.

Open-mindedness and a desire to improve are important prerequisites to progress but with a steadfast commitment to relying on data alone for decision-making at all times except at the time of meditation. Give the rational mind a well-deserved vacation or else it will become your worst enemy.

Carefully designed six sigma experiments should be a part of the course to instill a sense of confidence among the students that the practice of meditation is working. Student academic performance, health and wellness issues, self-reported sense of happiness and positivity, and subjective opinions of colleagues and family are measures that can be tracked. Heart rates and respiration rates at the start and at the end of meditation sessions will offer comforting evidence of progress. Bioenergy measurements will provide additional supportive evidence.

The author has presented talks on the two topics in several countries including the Congress of one to enthusiastic audiences. He has also included the Science and Practices of Internal Excellence in the mandatory Six Sigma course of the MBA program of the University of Kentucky in Athens, Greece that he has been teaching for eleven years, and the students love it. Working with a B-School in Pune, the author established Six Sigma Excellence Awards for corporate India in 2005. It is heartening that at least one overseas organization (in the United Arab Emirates) established an Award for Internal Excellence in 2014 at the directive of Crown Prince Sheikh Nahyan of the Government of UAE.

conclusions

This paper has attempted to explain the importance of internal and external excellence in the life of a college student. The suggested course is expected to help in making the education of the college students whole and complete. The ideas form the core of the scientific framework for world transformation toward a better and more peaceful world. Since today's students are tomorrow's leaders, movers, thinkers, and shakers, the

widespread adoption of the course has the potential to transform higher education and should be supportive in the quest for a better and a more peaceful world.

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