

CRACKING THE GENERAL EDUCATION CODE

Notes from an Extended Sabbatical
1984-2007

“Science is just the refinement of everyday thinking.”
- Albert Einstein

“You mean I’ve been speaking prose all this time?”
- Moliere

*“Yes, I am a Hindu. I am also a Jew, a Christian,
and a Muslim...”*
- Gandhi

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INTRODUCTION

Eight Challenges

General education programs sound great but fall apart in practice. The eight biggest problems are:

- 1.) the definition and measurement of success;
- 2.) cohesion across subject areas;
- 3.) integration with daily life;
- 4.) linkage with major life decisions.
- 5.) balancing depth of analysis and breadth of coverage.
- 6.) deciding what is really worth remembering discipline by discipline and how and by whom that decision is to be made.
- 7.) distinguishing between facts, processes, and attitudes.
- 8.) compromising instructor freedom and student choice in the name of the need for a common heritage and vocabulary.

The following set of tools can I think help address these challenges.

Four Tools: The Log, the Grid, the Before/After Test, and the Core Model

I

Logs (journals) have been used for millennia by men and women, young and old, in all fields. Benedictine monks and Puritan settlers tracked their spiritual pilgrimage toward grace. Darwin jotted down observations and drew connections between types of finches. Mathematicians and physicists charted their path toward discovery of natural laws. Captains logged their progress. Accountants kept watch on expenses and revenues. If used correctly, the same tool can turn a college or high school education from a random walk from course to course into a disciplined journey toward self-knowledge and mastery of a broad range of skills.

II

Grids too have been used by artists (eg. Albrecht Durer) as well as mathematicians and consultants as a vehicle for the clarification of complex multi-dimensional issues. Mathematical word problems, the bane of countless students, become much less daunting when a simple grid separates its components and facilitates tackling each step at a time.

The mutual leveraging of the grid and the log can bring a new level of integration and depth to any undergraduate general education program.

III

The “Before/After” test addresses both the issues of integration and success measurement. Courses can often seem like a random walk from one topic to the next, from one class hour to the next. The “Before/After” test tackles this head on.

Progress should be measured student by student. To do that a custom base-line must be established. The only way to do that is a detailed baseline assessment on the first day of class. Tremendous attention must be paid to the details of that test, because it should be what drives the very structure of the semester and of each class hour. The Before/After test actually forces the teacher to make a decision as to what really matters in their field, what is really at its core, what is really worth remembering, and how that can be tested.

This task will often force even brilliant researchers in any field outside of their specialist comfort zone. This is not the job they were trained for. This is not what they are paid to do. And their time and energy is limited.

But failure to complete this task will vastly reduce the odds of success in any course.

Making tough decisions and taking responsibility for them are among the most important things to learn as soon as possible in life. There is only one way to teach them: by example. This is an opportunity for teachers to model tough decision-making and taking responsibility once the bold decisions have been made and interesting topics excised from the curriculum in the name of depth of analysis of the essentials.

IV

At the core of the proposed core curriculum is a very simple model of, the scientific method, which is truly, as Einstein observed, just a refinement of every-day thinking, or if you will, common sense.

The model has eight steps:

1. observe,
2. ask,
3. guess,
4. test,
5. tell,
6. listen
7. record,
8. iterate.

To apply the model beyond your natural comfort zone requires a level of self-discipline that can also be simplified into a four-step model.

- a.) be confident,
- b.) be calm;
- c.) be patient;
- d.) take one step at a time.

The enemies of learning are fear (self-doubt), ignorance (misconceptions as to the nature of the task), and impatience.

The enemies are formidable and have many avatars, but they can be defeated.

Ready for battle?

CHAPTER ONE: THE DAILY AND EUREKA LOGS

The Daily/Subject Area Log

Writing disciplines thought and provides a foundation upon which to build a sustained argument. A journal collects thoughts in one place and facilitates continuity of thought from hectic day to hectic day. In the absence of such a device, constant wheel re-invention is the order of the day. Logs can be of as much use to physicists and biologists as much as to humanists and poets.

Each course in a general education curriculum should have as a daily requirement the writing of at least one paragraph prior to the day's class hour and another afterwards.

The purposes of the two paragraphs are to prepare for class with the articulation of questions and hypotheses with respect to the day's subject matter and to synthesize the knowledge gained during the class hour and after related research and reading into a reformulation of those questions and hypotheses.

The Eureka/Decision Log

Each core curriculum or general education course would have a class specific log or journal. However, there should also be a journal of journals or a EUREKA LOG for the highlighting of the quantum leaps in observation, understanding and insight over the college career of the student. Ideally, of course, each discipline-specific course should lead to moments worthy of the EUREKA LOG.

The Eureka Log should also include a discussion of the major decision points in a student's undergraduate life and the rationale behind them: eg. choice of major, minor, extracurricular activities, post-graduate plans, voting decisions, religious affiliation decisions etc.

The Gift that Keeps on Giving

The Eureka log in particular would become of priceless value to each student for the rest of his or her life. And imagine the value to their children, grandchildren, etc. Did your grandfather die before you were born? Mine did. I envied those more fortunate. Then, a few years ago, I found in the attic a box filled with articles and poems tracking his thoughts and feelings from 1914 to 1939. The elation was gut-wrenching.

CHAPTER TWO: THE WHAT MATTERS GRIDS

Journals are the key to continuity across time and connections across disciplines.

Grids are the key to analytical depth within disciplines and across disciplines. They are also an extremely valuable lesson in humility.

The challenge of “gridding” an issue is to define two or more axes or dimensions of the issue and to segment that dimension along a continuum using a quantitative or other unit of measure.

They are a standard tool of mathematicians, artists, and consultants.

They should be as much the bread and butter of undergraduates as the journal and the Saturday night party.

To grid an issue with appropriate depth as will be seen in the following pages, is to see graphically how little one really knows relative to one would like to know.

Of all subjects in school, math and physics are the most anxiety provoking because of their difficulty. Within math, the category of problems the most feared is word problems. As physics problems are in essence math word problems, physics is the more inherently intimidating of the two but can be more easily avoided in high school so has a less harrowing reputation.

The first step to solving math word problems is the grid them: that is to analyze them into their components and present them visually and then deal with each square one at a time.

History on the other hand is considered easy and soft relative to physics and math. But if you grid an historical issue, such as say the civil war into an x dimension segmented into “causes, course, and consequences,” a y dimension of “economic, political, and military factors”, and z dimension of “short, medium, and long term factors”, you can quickly appreciate the daunting challenges of in depth historical understanding.

CHAPTER THREE: BEFORE AND AFTER TESTS

I

The Before/After test breaks down a core discipline (physics, chemistry, drawing, music, history) into its key components and tests knowledge of and curiosity about them on the part of the student on the first day of class. Does student x have any clue about any part of the discipline? Has he ever had “fun” doing anything remotely related to any component of it? Has he spoken “prose” without knowing it? Does the kid who thinks he hates physics love fixing cars or playing baseball? Does the kid who hates literature know rap songs by heart? Does the kid who hated high school science love to cook?

II

The teacher must decide what is most essential to her discipline and avoid the temptation of trying to cover too much material. This is not easy. This is not what she was hired for or paid to do. This is not what she gets peer kudos for.

III

Here is where the problem of too many cooks can become a solution. The members of the general education committee who are not specialists can here really help the specialist in getting at what really matters in her field. The amateur or generalist can sometimes better see the forest for the trees.

IV

Small groups should be carefully created to take into account the right balance of students.

The “after” questions (ie. the final exam) should be identical to the “before” questions, giving a very concrete meaning to the question, “So what did you learn in that class?”

The response will be “Check out these grids.” Perhaps the student will pull the journal off the bookshelf. Or perhaps the grid will already be posted on his wall.

CHAPTER FOUR: THE CORE MODELS

I

The eight-step model of the scientific method could also be called an eight-step model of the learning process itself or of that rarest of things, common sense. As Mr. Einstein said, “science is just the refinement of everyday thinking.” If you don’t think the San bushmen are full of scientists, think again.

The model again is:

1. observe
2. ask
3. guess (hypothesis formulation)
4. test (data gathering, measurement)
5. tell
6. listen
7. record
8. iterate.

The challenge for the teacher is to take this model and apply it to the most powerful questions raised by her discipline. This will involve the design of a set of experiments. In one case, perhaps, each class hour will include one experiment. In another, there will be weekly experiments broken down into discreet stages for each day. In yet another, there could be just three experiments over the course of a semester. Or even, just one over a term. Each choice has different consequences.

II

The four-step model of self-discipline is one that is as relevant to the teacher as to the student. This, too, is best taught by example. When teachers are forced outside of their specialist comfort zone, the potential for their authority being challenged is far greater. The risk of looking like an idiot before a crowd much greater.

Remember the four step model: be confident, be calm, be patient, and take one step at a time.

PHYSICS:
What Matters Grids

	Body	Home	Car	Nature
Observation				
Question				
Guess				
Test – data, tools, unit of measure				
Tell				
Listen				
Record				
Iterate				

	Before	After
Principles		
Applications – self		
Applications – world		
Formulas		
Applications		
Experiments #1		
#2		
Summary Paragraphs		
Ability: self-assessment		
Joy/fun : self-assessment		
“Feelograms”/awareness		Posture, chores, rituals
Checklists/mantras		Path of sun, moon, planets

Coollest Questions for First Day of Class Exam: a.) what observations or questions get you to the roundness of the earth? b.) What observations or questions get you to heliocentrism? c.) How do you measure gravity? e.) How do you test whether or not a crown is made of pure gold? e.) How do airplanes fly? f.) What about birds? g.) Give five examples of leverage in your body and house; h.) How is your posture? Your teacher’s? Classmates? What is the long term consequence of different postures? How about weight? i.) Friend leaves key to house under mat. You get there. Can’t open door. What do you do? j.) What do you do when the toilet clogs? When the car dies?

Divisions into class by sport or artistic interest: sections based on tennis, art, golf, music, car repair, baseball, boxing, medicine, camping or conversely get a balance or diversity of hobby/job interest in each section to promote cross-fertilization of experience.

Alternatives for Syllabus Structure: use as backbone either: 1.) five (3?2?1?) coolest experiments ever in the history of physics (Archimedes, Newton, Galileo), 2.) five coolest observations; 3.) five (3?2?1?) coolest questions with examples from history and daily life juxtaposed whenever possible structuring it so students are presented at first just data and asked to connect dots themselves, followed by “peer instruction” discussion perhaps of the sort advocated by Eric Mazur.

CHEMISTRY
What Matters Grids

	Body	Kitchen	Nature	Car	Industry
Observation					
Question					
Test- data, tools, unit of measure					
Tell					
Listen					
Record					
Iterate					

	Before	After
Principles		
Applications – self		
Applications – world		
Formulas		
Applications		
Experiment #1		
Experiment #2		
Summary paragraphs		
Ability – self-assessment		
Joy/fun – self-assessment		
Feelograms, awareness		Mood shifts, diet changes
Checklist/mantra		Meals, foliage, pollution

First Day Questions: a.) Explain the chemistry of making bread and how it differs from making cookies. b.) Explain the chemistry of digestion; 3.) Explain the chemistry of caffeine, alcohol, aspirin; 4.) Explain the chemistry of your car; 5.) Explain the chemistry of air pollution, 6.) Explain the chemistry of water pollution.

Five, Four, Three, Two, One Most Important Experiments in History of Chemistry: and why they are so important in the judgment of the instructor and why peers might differ.

Link and relate life choices and consequences with respect to use of prescription and non-prescription drugs, choice of diet, ethical question of how much is enough and who is responsible and understanding of mechanics of operation and the definition of equilibrium. Should such linkages be excluded? Limited to 10% of time? Using oneself as a chemical lab rat has a certain appeal but has its limits. What are they?

BIOLOGY
What Matters Grids

\

	Self	Others	Animals	Plants	Other
Observation					
Question					
Test – data, Tools, unit of measure					
Tell					
Listen					
Record					
Iterate					

	Before	After
Principles		
Applications		
Theories		
Types of Evidence		
Experiment #1		
#2		
#3		
Summary paragraphs		
Ability – self-assessment		
Joy/fun – self-assessment		
Feelograms/awareness		Panic/fear/pain/pleasure
Checklist/mantras		Trees/flowers/birds/soil

	Fact #1	#2	#3
The Cell			
The Cycles			
The Food Chain			
Evolution			
Eco-system			
Sex			
Fight or flight			
Genes and Memes			

Questions for First Day: what questions can science answer? What questions can science not answer?

Useful Resources: PBS on Evolution, Magic School Bus, Standard Deviants, Dr. Wizard

MATHEMATICS
What Matters Grids

	Gambling	Investing	Economy	Baseball	Music	Art	Engin
Observation							
Question							
Test- data, tools, unit of measure							
Listen							
Tell							
Record							
Iterate							

	Before	After
Principles		
Applications		
Theories		
Proofs		
Experiments #1		
# 2		
#3		
Summary paragraphs		
Ability – self- assessment		
Joy/fun – self-assessment		
Feelograms/awareness		Counting, measuring, odds, randomness
Checklist/mantras		Duration, magnitude, how much is enough, g mean

First day questions:

1. **What is a bell curve and how does it apply to you?**
2. **What are odds of winning in different gambling activities?**
3. **What are the odds of making money in the stock market?**
4. **Is poverty a worse problem today than it was 10 years ago? How do you measure it?**
5. **What math problems can be solved with arithmetic, with algebra, geometry? Which need calculus?**
6. **What does math have to do with baseball, music, art?**

Useful sources: Alfred North Whitehead, An Introduction to Mathematics.
 Lancelot Hogben, A Mathematical History of Mankind
 Lancelot Hogben, Math for the Millions
 PBS
 Fogware
 Standard Deviants

SOCIAL STUDIES/CIVICS

What Matters Grids

	Family	School	Town	Nation	World
Observation					
Question					
Test- data, tools, unit of measure					
Listen					
Tell					
Record					
Iterate					

	Before	After
Principles #1		
#2		
#3		
Interests #1		
#2		
#3		
Republicans, Democrats Defined		
Feelograms/awareness		Envy, Greed, Fear, Pride
Checklist/mantra		The Grid test: how many Boxes can you fill in?

	Pro	Con	Compromise
Argument #1			
#2			
#3			
Facts #1			
#2			
#3			
Statistics #1			
#2			
#3			
Interests #1			
#2			
Precedents #1			
#2			

Useful resources: procon.org; congressional digest; almanac of American politics

WORLD CULTURES AND BELIEFS
What Matters Grids

	Christianity	Islam	Chinese	Hindu	Libertarian	Socialist
Similarities						
#1						
#2						
#3						
#4						
Differences						
#1						
#2						
#3						
#4						
Core Book						
#1						
#2						
Core quote						
#1						
Leader #1						
#2						
Event #1						
#2						

	Before	After
Knowledge (box count)		
Curiosity (question list)		
On-going Learning plan		
Feelogram/ Awareness		Revulsion/attraction
Checklist/mantra		Turban, fez, queue
Self-definition		
Self-assessment		

Great Strategic Turning Points in Religious Cultural History

	Economic	Political	Military	Cultural	Short	Medium	Long Term
Causes							
Course							
Consequences							
Conclusion							

Resources: world religions (DK), Pluralism Project (Harvard Divinity School)

US/WORLD HISTORY
What Matters Grids

	Leaders	Turning Points	Lessons	Differences
Observation				
Question				
Test- data, tools, unit of measure				
Tell				
Listen				
Record				
Iterate				

	Before	After
Principles: ranked		
Interests: ranked		
Issues: prioritized		
Heroes		
Villains		
Most important events		
Lessons of History		

Greatest and Worst Americans Ever
(Your Choice)

	GW	AL	TR	MLK	RP	CC
Positives #1						
#2						
#3						
#4						
Negatives#1						
#2						
#3						
#4						
Interesting						
Question Mark						

Resources: PBS specials on American Presidents, World War II, Revolution, Civil War
The Fog of War, Daniel Yergin, Commanding Heights, The Prize,
Biography channel on Mandela, Gandhi

PSYCHOLOGY
What Matters Grids

	Alone	Small Groups	Big Group	Crisis	Routine
Observation					
Question					
Test- data, tools, unit of measure					
Listen					
Tell					
Record					
Iterate					

		Before	After
Strengths	#1		
	#2		
	#3		
Weaknesses	#1		
	#2		
	#3		
Feelograms/awareness			Mood shifts, panic, fear
Checklist.mantras			Creating distance, time
Self-deception awareness			
Look analytics			
Other analytics			
How much is enough?			
Taking blame and credit			
Drugs: good and bad			
Sex: good and bad			
Food: good and bad			
Posture: good and bad			
Facial expression			
Voice: tone and volume			

Useful Sources: Relaxation Response, Herbie Benson series
Inner Game series

LITERATURE/LANGUAGE

What Matters Grids

	Vocabulary	Sentences	Paragraphs	Tone	Character
Observation					
Question					
Test – data, tools, unit of measure					
Listen					
Tell					
Record					
Iterate					

Greatest books	Aesop’s Fables	Ecclesiastes	William Blake	Pascal
Greatest religious books	Bible as literature	Analects	Koran	Bagavad Ghita
Greatest sentences				
Greatest paragraphs				
Greatest Essays				
Greatest poems				
Greatest songs				

	Before	After
Best sentence ever written: Yours, someone else’s		
Best paragraph ever written Yours, someone else’s		
Best essay ever written: Yours, someone else’s		
Attitude to words		
Attitude to sentences		
Attitude to paragraphs		
Attitude to a blank sheet		
What is an essay/		

Sources: EB White

ART – PERSPECTIVE DRAWING

Seeing What is Really There/ Finding Your Line and Style

What Matters Grids

	Center	Edges	Shapes	Lines	Shading
Observation					
Question					
Test – data, tools, unit of measure					
Listen					
Tell					
Record					
Iterate					

	Upside-down	Negative Sp	Before	Still	Other
Framing					
Plotting Key Points					
Light and Shadow					
Angles					
Negative spaces					
Basic Unit					
View Finder					
Can't; anxiety					
Pre- conceptions And Truth					
Upside down drawing					
Colors					

	Before	After
Your best drawing		
Your best painting ever		
Attitude to blank sheet		
Attitude to looking out window		
Attitude to going outside		

Resources: Betty Edwards books and videos;

MUSIC:
Finding Your Own Voice, Hearing and Feeling It
Playing your Favorite Song, Composing your own song

What Matters Grids

	Melody	Harmony	Rhythm	Pitch	Phrase	Self
Observation						
Question						
Test- data, tools, unit of measure						
Listen						
Tell						
Record						
Iterate						

	Before	After
Best song ever wrote t		
Favorite song is		
Can play it/can't play it		
Can sing it/can't sing it		
Can keep time/can't		
Sense of Pitch		
Vocal range is		
Can compose/can't		
Can harmonize /can't		
Abdomenal breathing		
Can distinguish:		
Major/minor		
Lower/higher		
Can read music/can't		
This song is in my range		
This song is not		

A SINGER'S GRID: The Physical and Mental Levers

	#1	#2	#3
Lift	Eyes	Sternum	Zygs
Relax	Brow	Jaw	Abs
Think	Pretty/kind	Less is more	Vertical
Hear/feel/Speak	Phrase	Tone	Rhythm/in sync

Resources: Kodaly, Hindemith, Ken Philips, Hines, Miller, McCloskey, Coffin

DANCE
What Matters Grids

	Feet	Knees	Hips	Shoulders	Head
Observation					
Question					
Test – data, tools, unit of measure					
Listen					
Tell					
Record					
Iterate					

	Waltz	Square	Tango	Charleston
Pattern alone				
Pattern with Partner				
Beyond pattern				

	Before	After
Can dance/can't		
Favorite dance is		
Best dance is		
Favorite step is		
The best dance I ever choreographed is		

TENNIS/SQUASH/BASEBALL/BOXING
Getting to Know Yourself, Getting to Control Yourself
Finding the “sweet spot” and the “happy zone”
What Matters Grids

	Forehand	Backhand	Serve	Physics	Geometry	Tactics	Strategy
Observation							
Question							
Test – data, tools, unit of measure							
Tell							
Listen							
Record							
Iterate							

	Theory	Observation	Adjustment	Observation	Adjustmen
Height					
Depth					
Feet					
Shoulders					
Hips					
Wrist					
Arm					
Feet moving					
Eye					
Knees					
Rhythm					
Contact Point					
Happy Zone					
Pendulum/Fluidity					
Video role					
Coach role					
Paragraph					
Mantra					
Visualization					

Take seriously the fact that sports are a combination of applied physics and applied psychology. To exclude them from general education programs is insane. To put them at the very center might make sense.

Autobiographical Note

Facts and Commentary

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The son of a Romanian immigrant I was indoctrinated very early on the absolute necessity of a Harvard diploma as a ticket to success and happiness. I would go to mass every day from age 6 to 12 and say countless Our Fathers and Hail Marys as part of a plea to the Almighty to grant me entrance into that holy place on the Charles. Being extremely goal oriented I got straight As in high school and graduated from Harvard in three years, Phi Beta Kappa and magna cum laude. But, to be honest, there was very little if any joy in this race for the sacred parchment.

Diploma in hand I felt cheated. I really didn't feel like I'd learned much of any thing in those three years. Anything I did learn was self-taught. I felt partly to blame. But only partly.

As a teaching fellow at Harvard a few years later, I vowed to improve the quality of education at Harvard. I applied for a grant from the Danforth Foundation to write a booklet for section leaders in the Core Curriculum. I met with leading pedagogues at every school in the university – from the law school, business school, medical school. The manual was published and entitled “A Common Sense Guide to Section Teaching at Harvard.” I also organized a discussion series at Mather House on the newly developed core curriculum and won a Danforth teaching award for work as a section leader in an international relations course that was then part of the Core.

With my PhD in hand I set out for Knox College in Galesburg, Illinois as an assistant professor of history. There, after extreme success as a teacher

over four terms, I was elected to chair the academic program planning committee to re-design the curriculum of the college.

However, for personal reasons, I had to move to Boston where there were no academic jobs to be had. Forced to re-tool to pay the bills, I became in turn a management trainee at a bank, a currency trader, an equity fund manager, a world renowned strategic investor, the CEO of a company, and a retiree.

It was then that I began to take the idea of general education really seriously. As an investor I had devised a rigorous curriculum for myself and others in a wide range of areas (energy, medical technology, retailing, etc.) and had found a long lost gene for engineering and organizational problem solving. I came to see the dollar value of decision-logging, detailed record-keeping, and market-based experiments in learning to counter the negative impact of self-deception and conventional wisdom.

Having missed a real “general education” earlier in life. I decided to use my leisure time to fill in the gaps. What I discovered was that mastery of any discipline crosses the amateur/professional divide. Amateurs can be objectively “better” than professionals as measured by quality of musical performance, the scores of tournament matches, the profit or loss from investment decisions, or the ability to identify species of bird or tree in the wild.

The essence of professionalism is a level of understanding of core principles and the ability consciously and methodically to adjust when things go wrong. Some high quality amateurs are extremely gifted but really don’t know what they are doing.

To my mind the essence of a top quality general education is to get the student to the first level of professionalism, to get them to where they can feel, smell, and taste the joy and discipline of physics, math, drawing, and a true level of understanding of the nature and amount of drudgery and failure that is involved in mounting the professional ladder in that area so that they can make an informed decision of whether or not to pursue that activity as a career or as a serious hobby.

CYNICS CORNER: *Rebuttal*

A cynic might argue that the history of general education reform over many generations proves the quixotic nature of the quest for this educational holy grail.

The argument for futility has several strong claims:.

- too many cooks
- incentives too low
- time and energy too limited
- fear of stepping on the toes of others
- fear of having one's toes stepped on
- professional narrowness of mind
- yen for cramming too much into a semester is irresistible

Rebuttal

- nothing ventured, nothing gained
- journals, logs, before and after tests, and the two core models have never been systematically integrated into a general education curriculum
- ready to give it a try?