

**The Joy of Creation and other  
Aspects of Education**

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## The Real Reasons for the Award

- I eat a lot of fish.
- I'm so disorganized, the students felt sorry for me.
- Because a rumor started that I give free food in my class.
- It really was meant for Will Gilette but the organizers got confused and were too ashamed to admit it later.

## What Should an Education Give you?

- A degree?
- A bad memory of 5 years of hard work without pay?
- Lots of unresolved questions about life in the real world?
- Plenty of obscure facts?

**What Should an Education Give you?**

## Some Personal Answers

- **1.0** Learning to be creative in work and life
- **2.0** Confronting Fears
- **3.0** Learning to examine life
- **4.0** Learning to have broad interests
- **5.0** Learning to write and communicate as well as one can.

## 1.0 On learning to Create

Here on this level sand,  
Between the sea and the land,  
What shall I do or write  
Against the fall of the night?

## Some paradigms for creation

- Collect Different viewpoints
- Look for Unexpected Connections
- Look for broad themes that you can exploit.
- Understand things deeply and then generalize
- Look out for interesting problems.
- Do not limit creativity to work.

## Different Viewpoints

$$(x + y)^N = \sum_{i=0}^N \binom{N}{i} x^i y^{N-i}$$

$x + y$   
 $x + y$   
 $\vdots$   
 $x + y$

**Coefficient = ?**

### Generalizes to multinomial theorem

- The combinatorial proof of binomial theorem is far more direct than algebraic and easily generalizes to  $(x + y + z)^N$
- With coordinate geometry, Descartes allowed geometry to be treated algebraically.
- Computer Scientists can approach problems like: systems thinkers, theoreticians, software engineers, architects, logicians etc.

## Unexpected Connections

- A boy Billy asks Banting why diabetics can't "borrow" inner cell juices (insulin) from other animals? *Stimulus*
- Banting reads that the problem is that the outer cell juices are too strong and destroy inner cell juices. *Initial Failure.*
- Banting reads article of humans with blocked ducts and how outer cells were destroyed. *Casually registered fact*
- Wham! Banting wonders what would happen if we intentionally close ducts on a test animal, destroy outer cells, then retrieve inner cells. *Unexpected Connection.*

## Some other unexpected connections

- Stephen Hawking connects black hole formation to big bang theory by playing equations backwards.
- Richard Karp finds an obscure paper about NP completeness of an obscure problem called satisfiability and connects it with 14 tremendously important optimization problems.
- Other beautiful connections between randomness, computability, checkability, approximations, and Interactive Proofs.

## Broad Themes

- Designing middleware for networks that have both structure and performance.
- Seeking a cure for dying nerves by understanding the role of macrophages when nerves die.
- Seeking out bottlenecks in networking and removing them by algorithmic techniques.

## Understanding to Generalization

- David Hilbert spends 2 years unifying results in number theory to write a book. Then bang! A slew of great results on number theory.
- A much more modest example: spent time understanding why a certain protocol did not work with failures. Then was easy to show that all protocols did not work with these failures.

## Finding Interesting Problems

They're everywhere!

- *Setting*: Wanted to give a diagnostic surprise quiz in class to find out what students knew. Wanted to know scores but not to embarrass students → **Anonymous Score Collection**:
- *First solution (Jerry Cox)*: Professor writes a random number on a piece of paper and passes it around. Students add their scores to running sum. Prof subtracts random number to get sum.
- *General Solution (Adam Costello)*: Professor writes down  $n$  random numbers, one for each student.

## Puzzles

Great way to begin enjoying problems. Here is one about two numbers  $x, y$ ,  $2 \leq x < y < 100$ . Person  $A$  knows  $xy$ . Person  $B$  knows  $x + y$ .

- $A$ : “I don’t know the two numbers”
- $B$ : “I knew you wouldn’t know the two numbers.”
- $A$ : “Now I know the two numbers.”
- $B$ : “Now even I know the two numbers.”

What are the two numbers?

## Some Resources

- George Polya: “How to Solve it.”
- Martin Gardner: “Aha, Insight” and a number of others.
- Douglas Hofstadter: “Godel, Escher, Bach”

## Moving Creativity beyond Work

- Mother Theresa: on offering to serve as an air hostess to get free plane tickets.
- Tony Campolo: throwing a surprise birthday party for a unhappy lady, who had never had one, at 3 at night.

## 2.0 Confronting Fears

## Some Fears of Mine

- Will I ever learn to tie my shoe laces (Age 5?)
- Will I ever get a program to work (Age 20) after never getting rid of compilation errors on an ancient machine that took 3 days to turn around.

### 3.0 Examining Life

The unexamined life is not worth living.

--- Socrates.

I wanted to confront life to see what it  
had to offer.

--- Thoreau

## What is Life About?

- What is life all about?
- What is my purpose in it?
- Where am I going?

The point of education is sometimes to raise questions, and to sometimes supply some possible answers.

## Why this Fish Swims

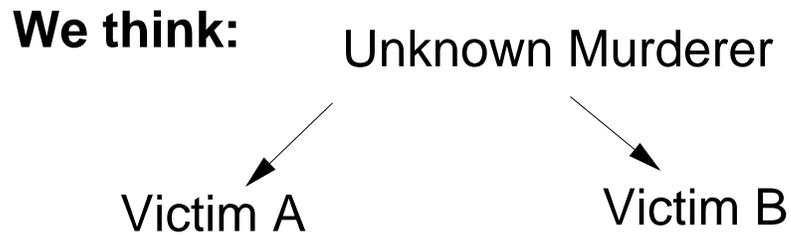
- I'm unashamedly a Christian and an intellectual. Not about being perfect but being forgiven and moving in the right direction.
- I enjoying continuing to learn under (to my mind) the greatest teacher I know: Jesus Christ. For me, He's the Big Fish.

Hope you will seek after truth.

## 4.0 On Having Broad Interests

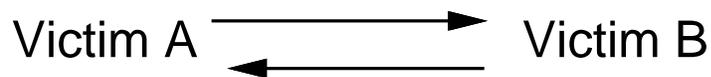
- *History*: Toynbee's Challenge Response theory that civilizations grow in response to adversity and not to comfort.
- *Philosophy*: Plato's Republic begins (first 15 pages) examining ethics, then launches into a gigantic metaphor between a man and the State, outlines the Ideal State, and then (last 10 pages) returns to Ethics!
- *Literature*: Heals us from the curse of individuality and allows us to be a thousand people. To Scotland with Stevenson, Elizabethan England with Scott, nunnery with Godden.
- *Economics*: Fractional reserve system and the money supply. Thurow's book.

## Detective Stories



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**But really:**



- John Dickson Carr's "The Hollow Man". Greatest locked room mystery I know.

## 5.0 On Writing

Reading maketh a full man, conference a ready man, and writing an exact man.

--- Francis Bacon

To write well is not to indulge in rhetorical flourishes but to observe keenly, to think clearly, and to feel deeply.

--- Paraphrased from a Eulogy to C.S. Lewis

## Writing

- Strunk and White: “The Elements of Style” is a wonderful resource.

There are specifically Japanese sounds. A sort of whoam, whoam -- that’s the treadle for flailing when the rice is harvested, and the clitter-clatter of wooden pattens on the paths; just as the paper door screens make an unmistakably soft shirring when they are slid back.

Rumer Godden, *In this House of Brede*

## In Conclusion

I hope you will:

- Be creative
- Confront your fears
- Examine Life
- Have Broad Interests
- Enjoy Writing and Communicating Effectively