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# **Mathematics**

# **The Language of Critical Thinking**

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STEM Institute, February 26, 2016



# Outline

- Introduction
- Some Historical Background
- The Food Science Program
- Language
- Skill/knowledge Transfer
- Values



M.S. Chemical Eng. ●  
Ph.D. Eng. Sci.



B.S. Chemical Eng.



● Lycée André Honorat



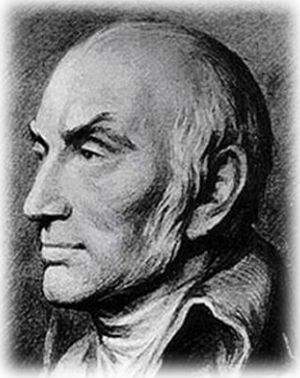
# History



Antoine Lavoisier  
(1743 – 1794)



[www.britannica.com](http://www.britannica.com)



Nicolas Apert  
(1749 – 1841)



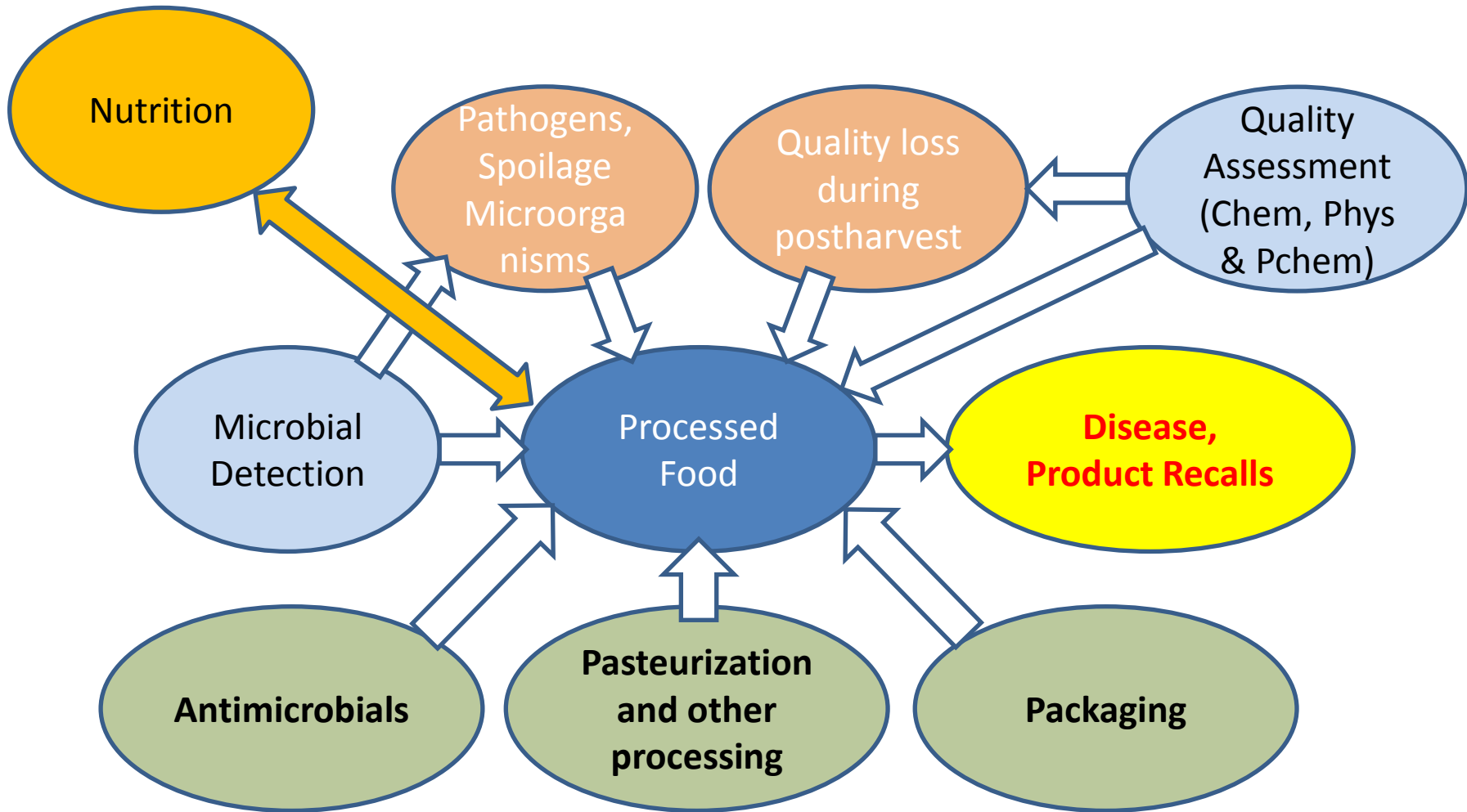
Pierre Simon Laplace  
(1749 – 1827)



# Today's Food Science Graduates

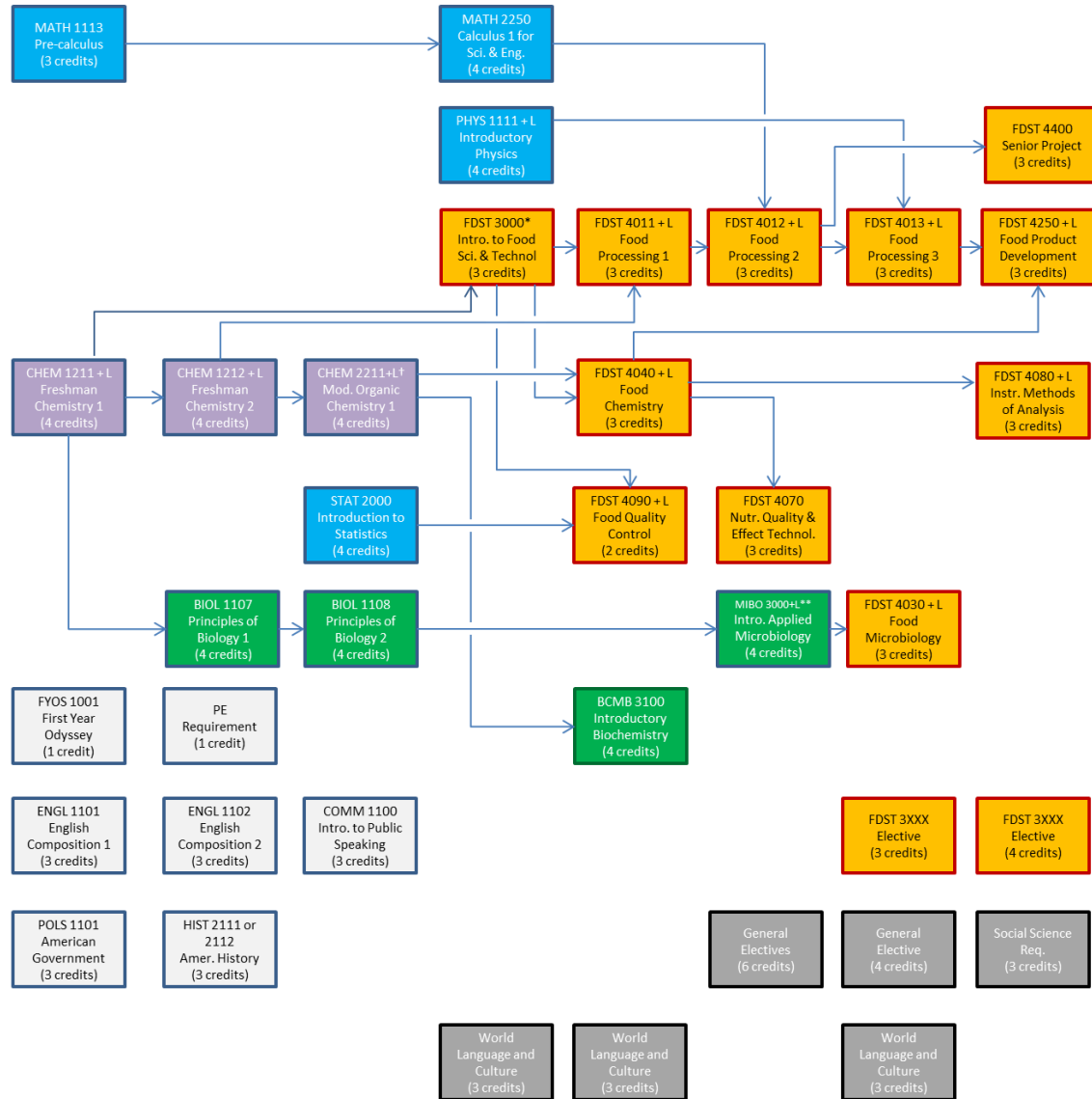
- Know more chemistry than Lavoisier's ever dreamed
  - Two freshmen chemistries and one organic chemistry
- Know more about food preservation than Apert in his 92 year.
  - They understand microbiology, biochemistry, and processing principles
- Know only a fraction of what Laplace knew about math

# Issues in Food Processing



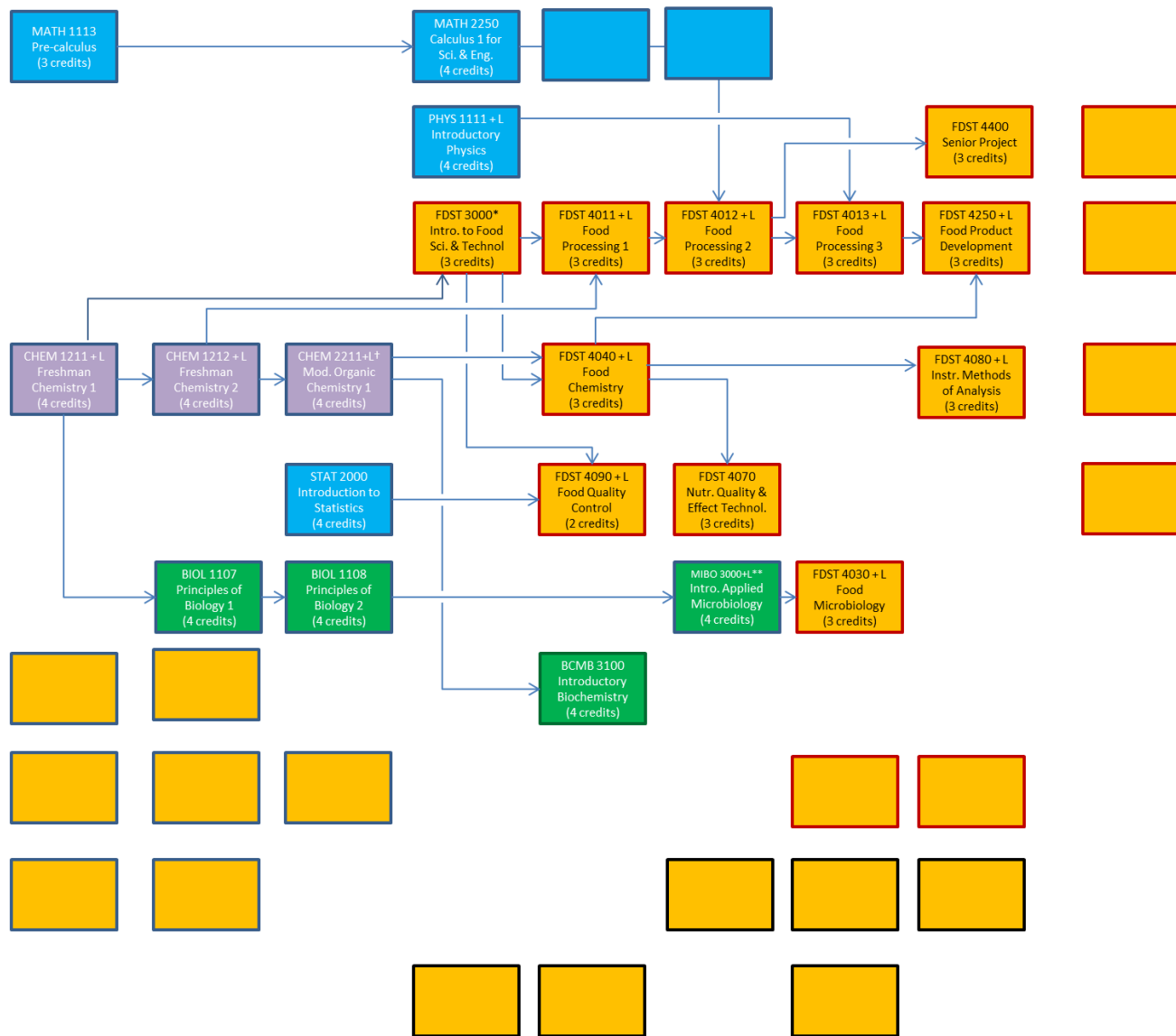


YEAR 1 FALL	YEAR 1 SPRING	YEAR 2 FALL	YEAR 2 SPRING	YEAR 3 FALL	YEAR 3 SPRING	YEAR 4 FALL	YEAR 4 SPRING
<b>NUMBER OF CREDITS (TOTAL 121)</b>							
<b>14</b>	<b>15</b>	<b>15</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>16</b>	<b>16</b>





YEAR 1 FALL	YEAR 1 SPRING	YEAR 2 FALL	YEAR 2 SPRING	YEAR 3 FALL	YEAR 3 SPRING	YEAR 4 FALL	YEAR 4 SPRING
NUMBER OF CREDITS (TOTAL 121)							
14	15	15	14	15	16	16	16



# Parlez-vous Παθη?

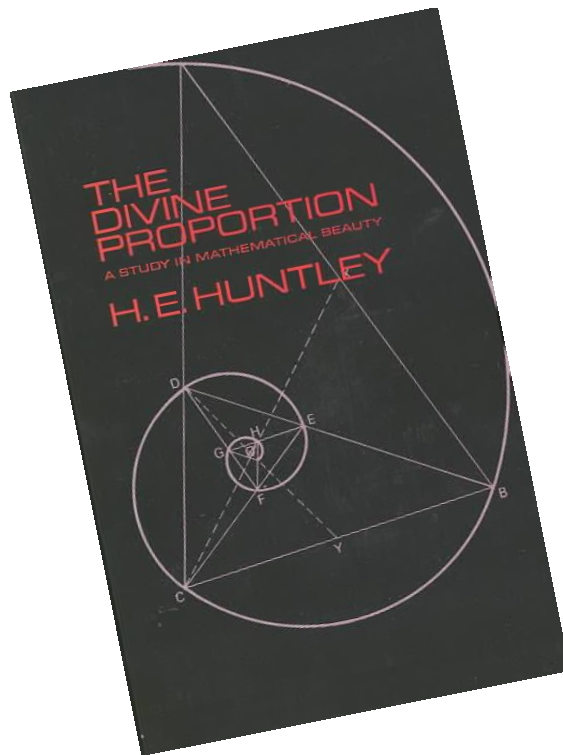
What does math look like in the mind of an average student?



How can we make math more appealing to students?

# Parlez-vous Παση?

- What triggers the interest of an individual to learn another language?



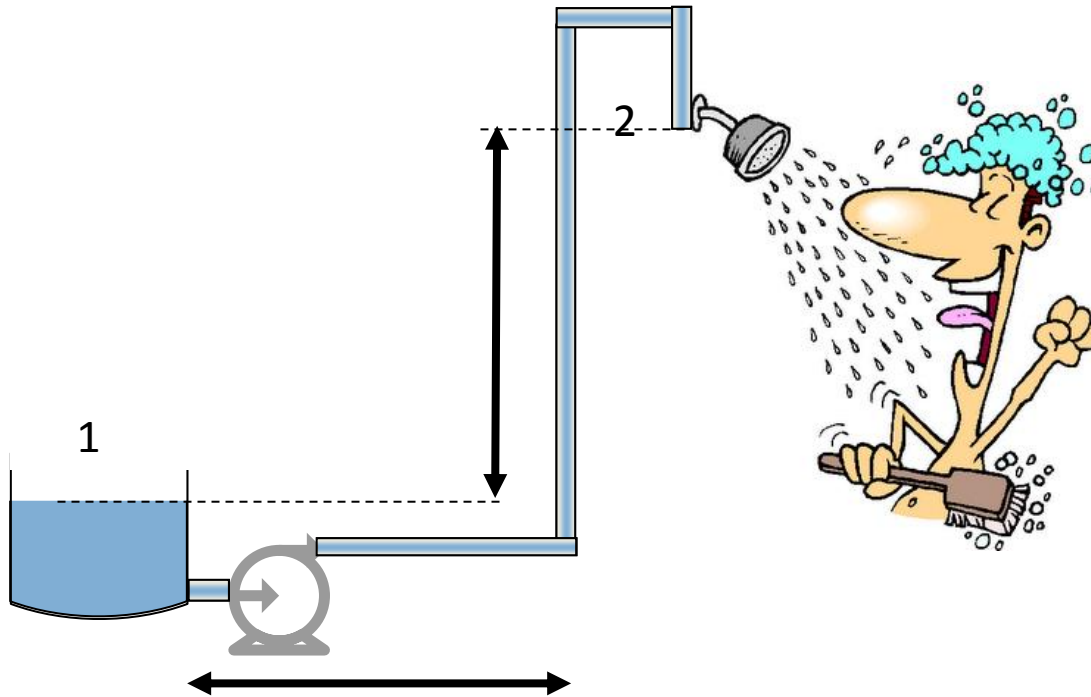


# Parlez-vous Παση?

- What triggers the interest of an individual to learn another language?
  - Need to understand
  - Need to communicate
  - Need to make choices
  - Need to create

# Bernoulli

$$W_p = \frac{P_2 - P_1}{\rho} + \frac{g(Z_2 - Z_1)}{g_c} + \frac{(v_2^2 - v_1^2)}{2g_c} + \frac{2f\bar{v}^2 L}{g_c D} + K_{fe} \frac{\bar{v}_a^2}{2g_c} + K_{fc} \frac{\bar{v}_c^2}{2g_c} + K_{ff} \frac{\bar{v}_a^2}{2g_c}$$





# Math as a Language

- Propositions
  - Axioms (considered often as self-evident/true)
  - Theorems (can be proven/derived)

Characterized as true or false

Often describe natural phenomena

Extended to social sciences and economy

# Truth vs. Fantasy

- You are awesome vs. your work is awesome



You can't handle  
the truth!





# Hypothesis

- Students that develop stronger quantitative skills become inherently better critical thinkers.
- On-line learning modules





# Expected Results

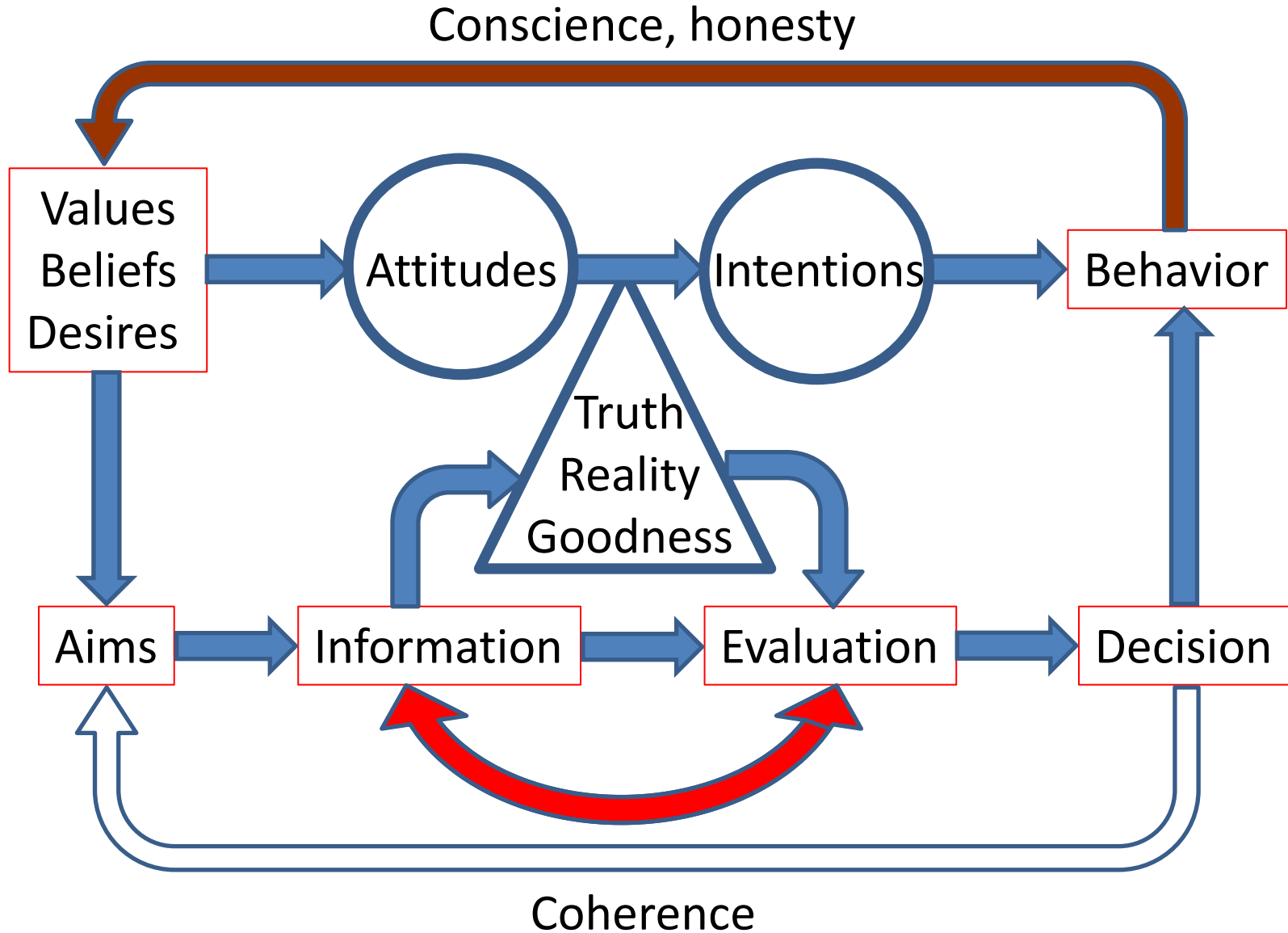
- Improved quantitative skills of the type that are covered in the modules
- Quantitative skills of one type will transfer to quantitative skills of a different type
- Quantitative skills will transfer to critical thinking and decision making of in unrelated topics.



# Experiment

- Split the class into 2 randomly.
- Pre-assess both groups to make sure there are no significant differences in critical thinking
- Assess after half of the group has been exposed to the modules
- Determine whether and the type of differences

# Decision Making





# Critical Thinking

- Drive the choices that we make, provided that the mechanism by which we assess the options is rigorous and honest.

## Moral Thinking (Food for Thought)

- Prioritize what is urgent
  - All human beings are equally worth
  - All animals are equally worth
  - Humans and animals are equally worth



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**THANK YOU!**

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