

# How many trees in that forest?

(One tool for) cultivating numerical literacy  
across the science curriculum

Ed Hudson  
John Abbott College

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# Principles for this workshop:

- “Give me (a) tool(s)”
- “Involve me (have me do something)”
- “Less is more” - a few core ideas

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What is the mass of this building?

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“Consider the reaction between gaseous hydrogen cyanide (HCN) and hydrogen gas to form gaseous methylamine ( $\text{CH}_3\text{NH}_2$ ).  $\Delta H$  for this reaction is  $-158 \text{ kJ/mol}$  of methylamine formed. Calculate the bond energy between C and N in HCN using the following data. . .”

*(From a General Chemistry (202-NYA) final exam, John Abbott College, ca. 2009)*

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- Which is the tougher question?
- When we teach the specific, do we (or students) lose sight of the general?

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# (How) is (in)numeracy a problem?

“When technology fails, they’re lost”

“They don’t know how to go from general to specific”

- *Economics teacher, JAC*

“In Geography courses, numerical literacy is an important component of assignments, but a student could . . . fail them and still pass”

- *Geography teacher, JAC*

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# (How) is (in)numeracy a problem?

"...numeracy is not the same as mathematics, nor is it an alternative to mathematics. . . Whereas mathematics asks students to rise above context, quantitative literacy is anchored in real data that reflect engagement with life's diverse contexts and situation"

- Lynn Steen, quoted in *Tout* (2014)

Tout, D., 2014, Some reflections about mathematics and numeracy from PISA and PIAAC, [http://www.centreforliteracy.qc.ca/sites/default/files/DaveTout-math\\_nmcy\\_PISA\\_PIAAC.pdf](http://www.centreforliteracy.qc.ca/sites/default/files/DaveTout-math_nmcy_PISA_PIAAC.pdf), accessed 02/06/15

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# Recipes for 'large number paralysis'

- The United States burns *one billion tons* of coal per year
- Saudi Arabia produces *10.5 million barrels* of oil per day
- Over *\$200 billion* has been invested the Alberta tar sands
- The Alberta tar sands cover an area of *140 000 km<sup>2</sup>*
- In 2012, Quebecois consumed *168.0 TWh* of electricity

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“The most essential gift for a good writer is a built-in, shock-proof, s--t detector”

*-Ernest Hemingway*

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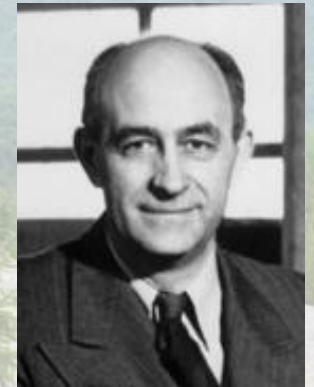


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**Enrico Fermi (1901-1954)**

Uncanny talent for making rough numerical  
predictions using simple math and readily  
estimable numbers (*Fermi Estimation*)



<http://fermi.lib.uchicago.edu/fermibiog.htm>, accessed  
02/06/15

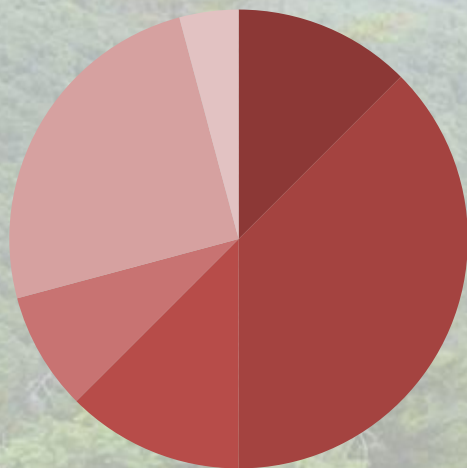
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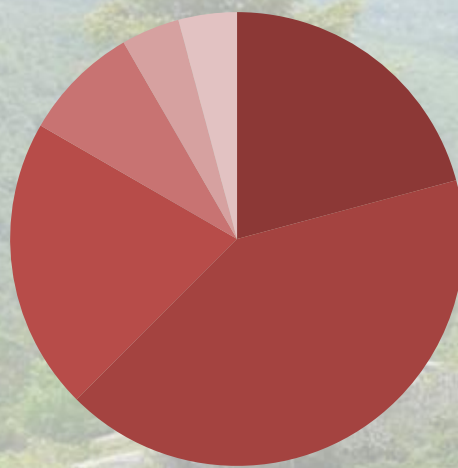
# Student feedback (1)

(23 respondents) (ca. 25%)

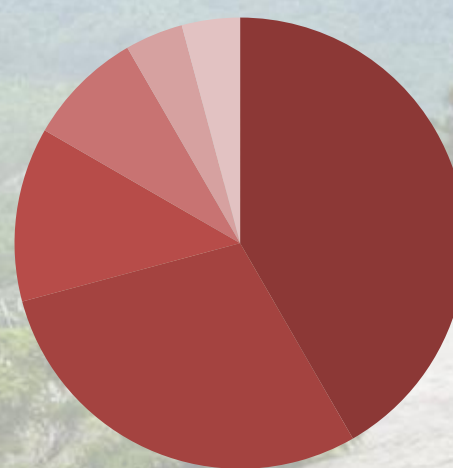
“I had used or encountered the ideas or skills in this workshop before”



“This workshop made me less reluctant to roughly estimate unknown quantities”



“I enjoyed the workshop”



- strongly agree
- agree
- neutral
- disagree
- strongly disagree
- (not applicable)

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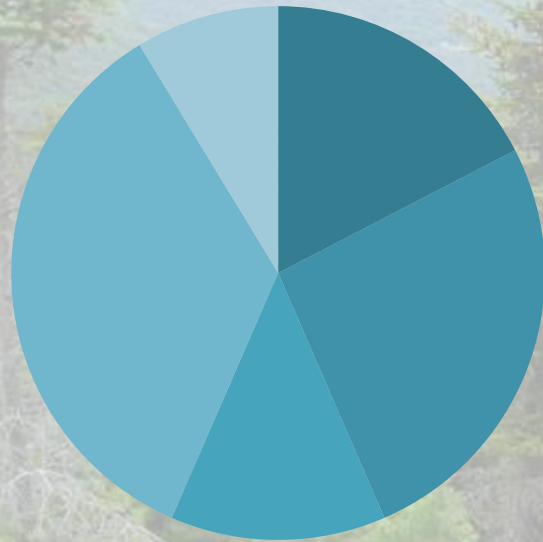


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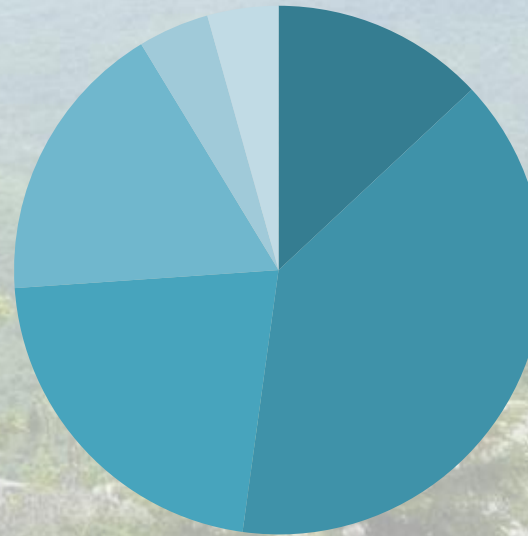


# Student feedback (2)

“I have used the skills or ideas from this workshop in another course”



“I have used the skills or ideas from this workshop outside a course (e.g., when reading news)”



- strongly agree
- agree
- neutral
- disagree
- strongly disagree
- (not applicable)

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# Student feedback (3)

(Best or most useful thing about workshop)

“It makes you take a new perspective when approaching a problem, and it helps shift the mental approach from "plug in numbers" to "understand the problem". “

“It showed us that we don't need to be scared of a task that is overwhelming at first glance.”

“Seeing how other students estimated differently and sometimes took different factors into account but the calculations still made sense.”

“Please keep doing this workshop. It teaches more than just chemistry, it's a skill! “

“This was one of my favorite workshops. I wish this skill (and the logic behind it) were more emphasized in general science education.”

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# Student feedback (4)

(Worst or most frustrating thing about workshop)

“It was difficult to find legitimate sources/concrete numbers off the internet to use in our estimation and calculations.” (6 ×)

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Thank you!

*Thoughts?*

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