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Development and Validation of an Open Ended Assessment - Creative Excercises

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Development and Validation of an Open Ended Assessment—Creative Exercises

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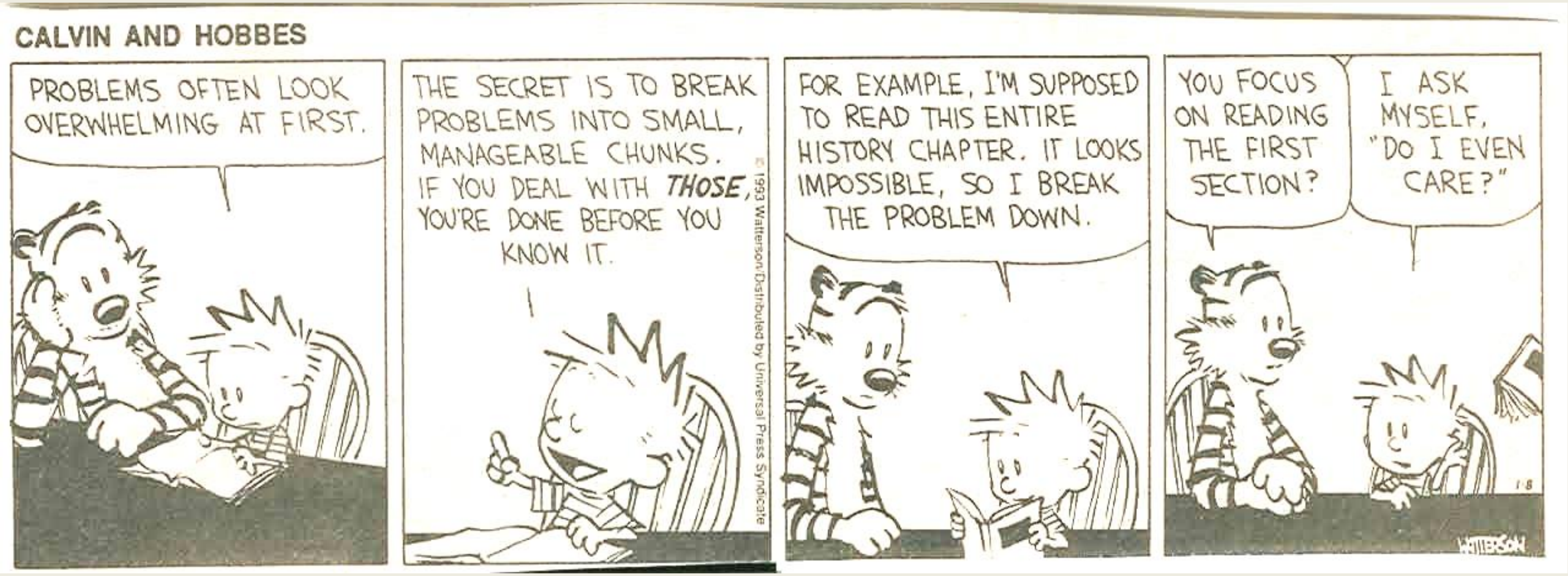
Creative Exercises

- What are they?
- Why bother?
- Data so far
- Misconceptions discovered
- DIY- Do It Yourself

Assessment practices influence how students direct their efforts in a class.[1]



Trigwell, K., and Sleet, R. (1990). Improving the Relationship Between Assessment Results and Student Understanding. *Assessment and Evaluation in Higher Education,* **15**, 190 – 197.

Creative Exercises

- First proposed by Trigwell and Sleet in 1990
- Consists of a brief prompt
- Students write distinct, correct, and relevant statements about the prompt.
- Example.. 2.2 g of NaCl

Why is this a good idea?

- Provides an opportunity for students to select and present their own knowledge
- Allows students to draw conceptual relationships
- Allows instructors to find misconceptions
- Similar to concept mapping
- Quick

Questions that Need to Be Answered

- Are CEs an accurate measure of chemistry knowledge?
- Are CEs scored consistently across different classrooms? Across institutions?
- Do students gain useful information?
- Do instructors gain useful information?

Nationally Standardized American Chemical Society (ACS) Exam

Correlations of CEs with ACS Exams

Assignment	Grader 1, ACS Exam	Grader 2, ACS Exam	Grader 3, ACS Exam
Homework CE's Average Correlation	0.232	0.222	0.186
Exam CE's Average Correlation	0.521	0.506	0.483
Overall Average Correlation	0.361	0.349	0.318

95 % confidence limit = +/- 0.151

Lewis, S. E., Shaw, J. L. and Freeman, K. A. Establishing Open-ended Assessments: Investigating the Validity and Reliability of Creative Exercises, accepted for publication in ***Chemistry Education: Research and Practice.***

Grading Reliability

Average Intra-Class Correlations- shows ranking reliability

Assignment	Grader 1, Grader 2	Grader 2, Grader 3	Grader 1, Grader 3
Homework CE's Average Correlation	0.764	0.844	0.763
Exam CE's Average Correlation	0.886	0.845	0.858
Overall Average Correlation	0.818	0.844	0.805

Grading Reliability

Cohen’s Kappa values- shows consistency of actual score

Assignment	Grader 1, Grader 2	Grader 2, Grader 3	Grader 1, Grader 3
Homework CE’s Average Kappa	0.435	0.475	0.435
Exam CE’s Average Kappa	0.458	0.391	0.415
Overall Average Kappa	0.445	0.438	0.426

Misconceptions

Early in the semester:

Prompt: **31.5 g of K_2S (alternate: 55.4 g of Na_2O)**

Some student responses:

- Students identify the compound as ionic,
  but use covalent naming rules
- Students will mislabel charges,
  indicate charge of K_2 as +2
- Students refer to K2 molecules and S molecules
- Students assign an incorrect charge to the entire formula unit,
  "it has a charge of -1"
- IF given Na_2O,
  identify compound as containing N atoms.

Misconceptions 2

In discussing chemical reactions:

Prompt: $MgCl_2(aq) + K_2CO_3(aq) \rightarrow$
Students will correctly predict the products of this reaction,

$MgCl_2(aq) + K_2CO_3(aq) \rightarrow 2KCl(aq) + MgCO_3(s)$

but then solve for the moles and mass of KCl formed even though they have correctly labeled it as aqueous in the balanced reaction.

When given a double displacement reaction in solution (complete with reactants and products), a number of students indicated one of the reactants as the solute and the other reactant as the solvent, in spite of the (aq) label on each reactant.

Misconceptions 3

The thermodynamics of chemical reactions:

Prompt: $2BF_3 + 3Cl_2 \rightarrow 2BCl_3 + 3F_2$ $\Delta H = 1466$ kJ/mole and given a mass of Cl_2 and excess BF_3

Students will try to determine ΔH of an individual component by dividing the ΔH_{rxn} by the stoichiometric coefficient

Ex: ΔH for $Cl_2 = 1466/3$

Students will label BF_3 and BCl_3 as ionic (indicating a cation and anion) then name them using the covalent naming scheme

Students will solve for ΔT of the reaction using ΔH, mass of Cl_2 and the Specific heat of water (even though no water is present.)

Misconceptions 4

In quantum mechanics:
Prompt: n=3 l=1

Students correctly identified the two quantum numbers: N is the principle quantum number, l is the angular momentum quantum number

but that they did not link the two values together
n is principle QN and possible l values for this n value would be 2, 1, and 0

Students will list electron configurations and quantum numbers for molecules, even though that has never been discussed. Ex. Cl_2

Project Participants

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