

## Why collaborate online? ...and why Google Drive?

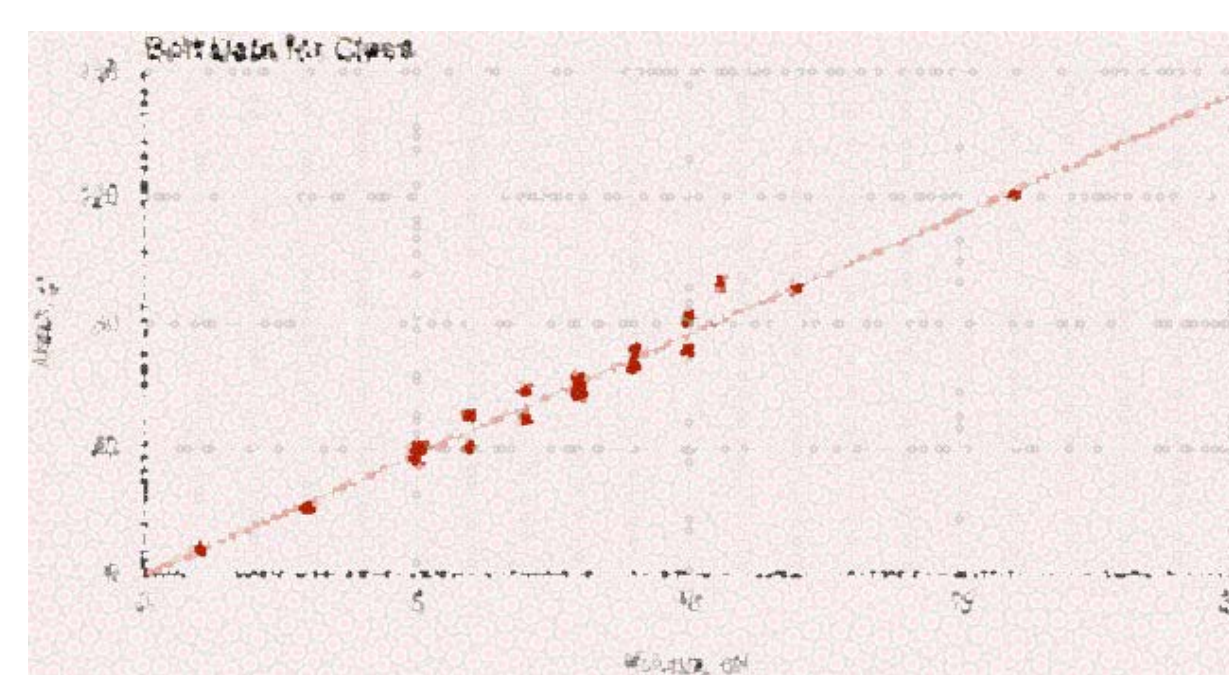
- 21st century technology skills
- anywhere/anytime in the cloud
- not a well practiced skill in undergraduate education
- constructivist approach
- cooperative learning
- Google Drive free and easy application

## Google Drive collaborative tools...

Activity in Gen Chem I/II or Workshop	used	doc	form	sheet	graph	chat
Investigating Mass-Volume Relationship	GC 1	X	X	X	X	
Nuts & Bolts of Extrapolation	GC 1		X	X		X
Nuts & Bolts of Let's Make an Error	GC 2		X	X		X
Beer's Law - lab & uses a PhET sim	GC 1	X		X	X	X
Investigating Chemical Reactions II	GC 1	X X				X
Investigating the Stack Height of Cookies	GC 1 & W		X	X	X	
Radioactive Decay by M&M's Flipping	W		X	X	X	
Flipping a Penny: Real or Fabricated Data	W		X	X	X	

## Creating a competitive environment: form > sheet > graphing

- easy pooling of data
- real-time graphing and computations
- class statistics and error
- group-to-class comparison
- getting students into mathematical modeling



## In-lab discussion via chat (upwards of an hour)

- using lab group accounts setup in Gmail allows for semi-anonymous discussion
- prompting for supporting evidence
- stimulating argumentation moderated by the instructor
- with student experience could be peer-led

## Students produce collaborative reports

- use revision history to judge participation by students (Google now counts edits by each participant)
- students workout logistics of who does what
- comparisons: group-to-class data
- group grade
- considering peer evaluation of participation
- can grade online – written or voice comments

## Collaborate on a computational spreadsheet

- students working in pairs & share with instructor (more of a collaborator!)
- compute (ratios, logarithm), graph, derive a simple mathematical relationship via regressions
- helps eliminate spreadsheet errors

## NEXT PHASE: Three projects in Google Sheets

- Materials Density (basic and advanced versions)
- Successive Approximations
- Radioactive Decay: Activity vs. Number

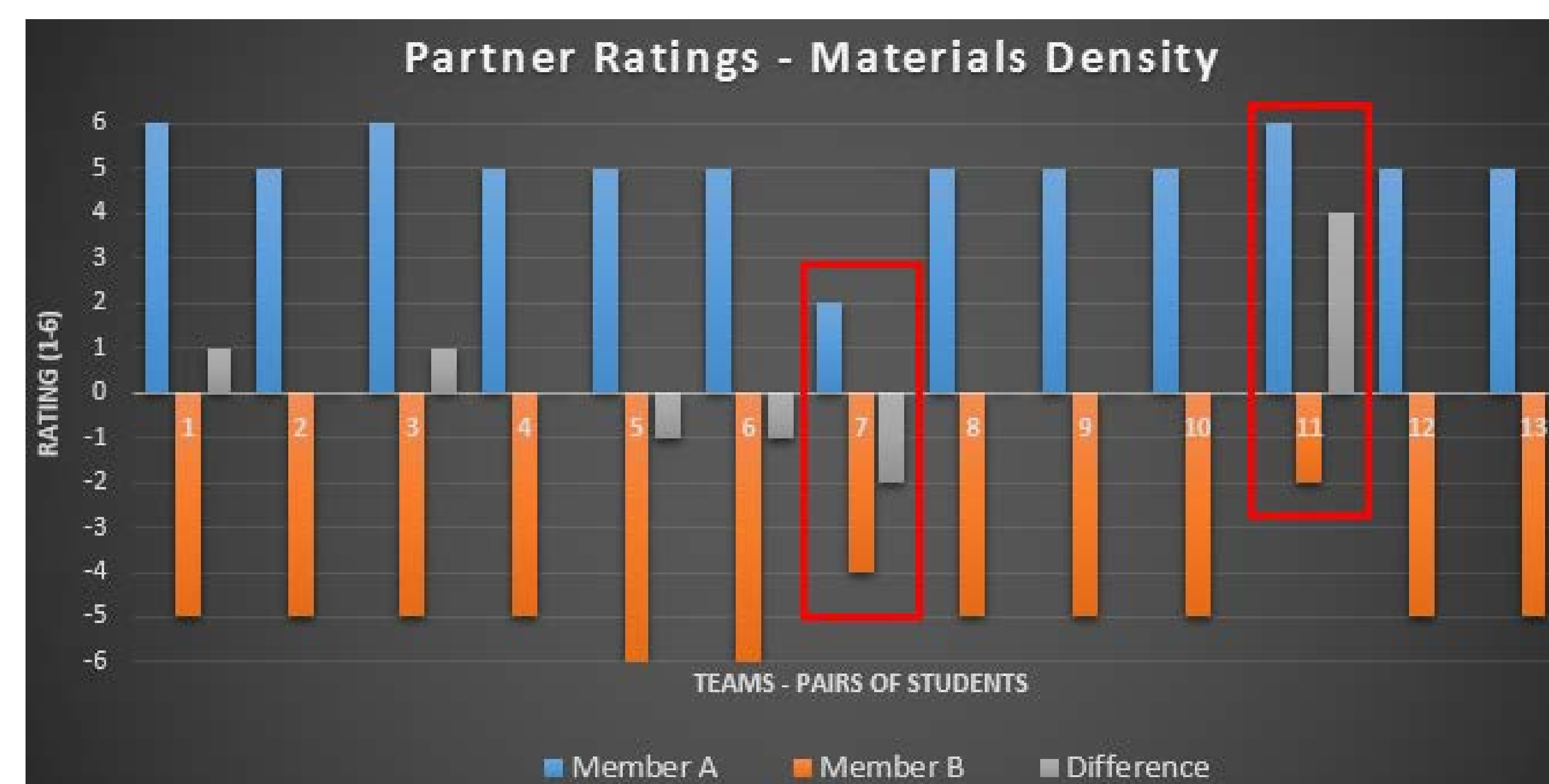
## Student feedback

Rate your partner in terms of collaborating on this project. Check one box that matches your feeling concerning the work effort of your partner.

worked harder than I did (6)	worked as hard as I did (5)	almost as much as I did (4)	they did about so, so (3)	they did very little (2)	they did nothing (1)
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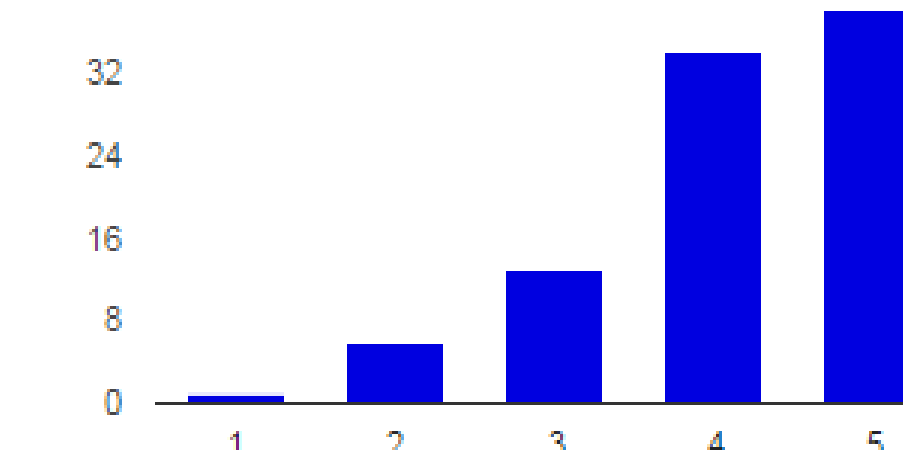
Students then explained why they gave the rating.

Comparison for each pair of students is given below (n = 13 pairs):

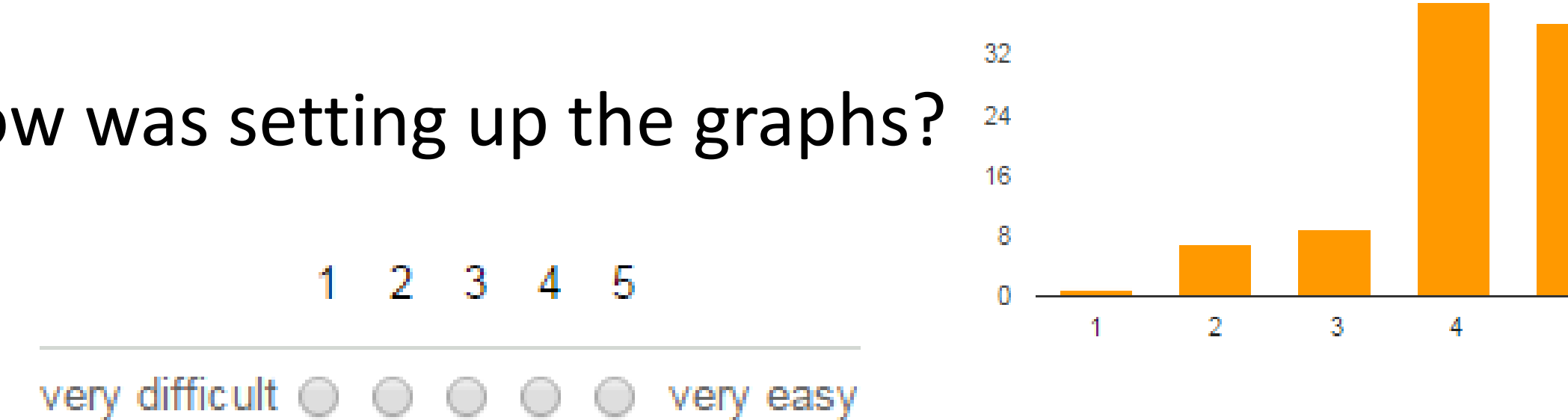


To try to eliminate some partner frustration, we went to two due dates, spreadsheet due before questions. Two groups above had problems!

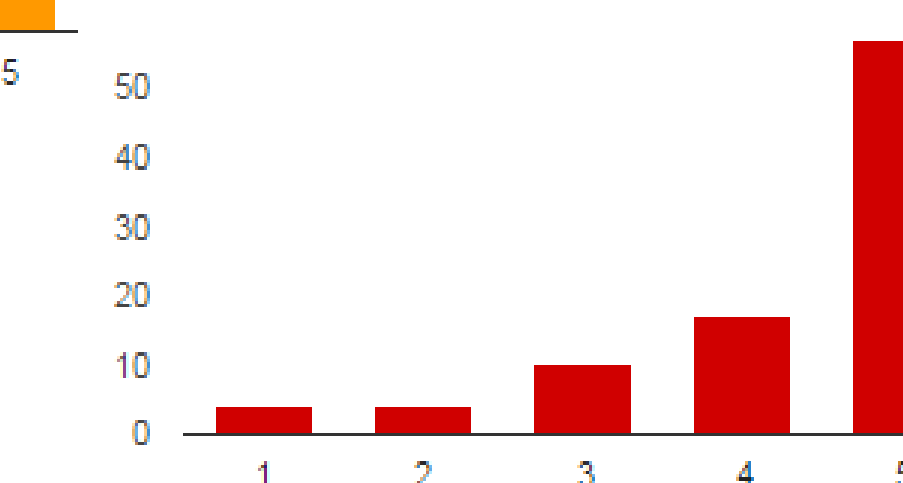
From Radioactive Decay Project (n = 92 students): How was setting up the computations on the spreadsheet?



How was setting up the graphs?



How was working with your partner?



## Assessing (post-activity)

How are activity, A, and number of nuclides, N, related?

answer	Percent (n = 92)
exponentially	27.2%
linearly	50%
by the half-life	15.2%
not related	2.2%
don't know	5.4%

Still work to be done!

## In conclusion...

- use of 21st century technology gives students a real experience
- increased engagement
  - student-to-student on their time
  - instructor-to-student
  - instructor as collaborator!
- enhances data analysis and interpretation
- introduces mathematical modeling
- strengthens computational spreadsheet skills

## More info

- to get started, see [Data Pool in the Cloud](#) (just Google it or scan)
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  - email: [ssinex@pgcc.edu](mailto:ssinex@pgcc.edu)
  - <http://academic.pgcc.edu/~ssinex>

