

Visualizing and Interpreting Data – Tools for Students and Faculty

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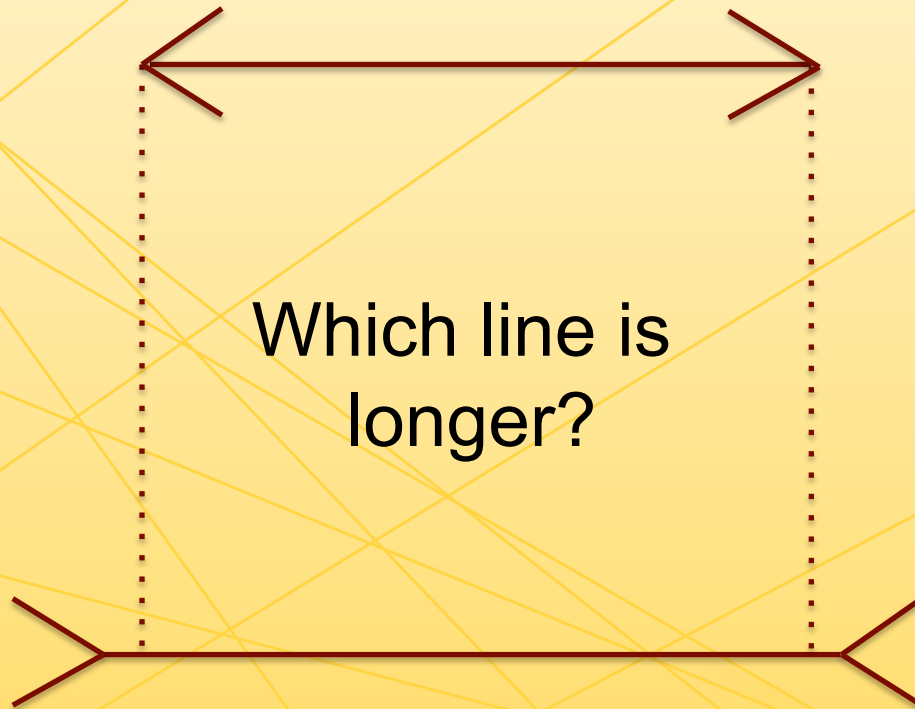
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How hard is it to visualize and interpret data?

- Can students do it?
 - Development of the tool: ChemEd X Data
 - Application of the tool
- Can faculty do it?
 - Development of the tool: BoSCO
 - Application of the tool



Can students interpret data?



Often, we remember older problems and apply to new problems the **older solution**

In an ever changing world older solutions may not be that useful

higher-order thinking is more important than ever

ChemEd X Data

<http://chemdata.r.umn.edu/> Teaching chemistry with visual representations

How does molecular structure
affect physical properties?

Give me the data!

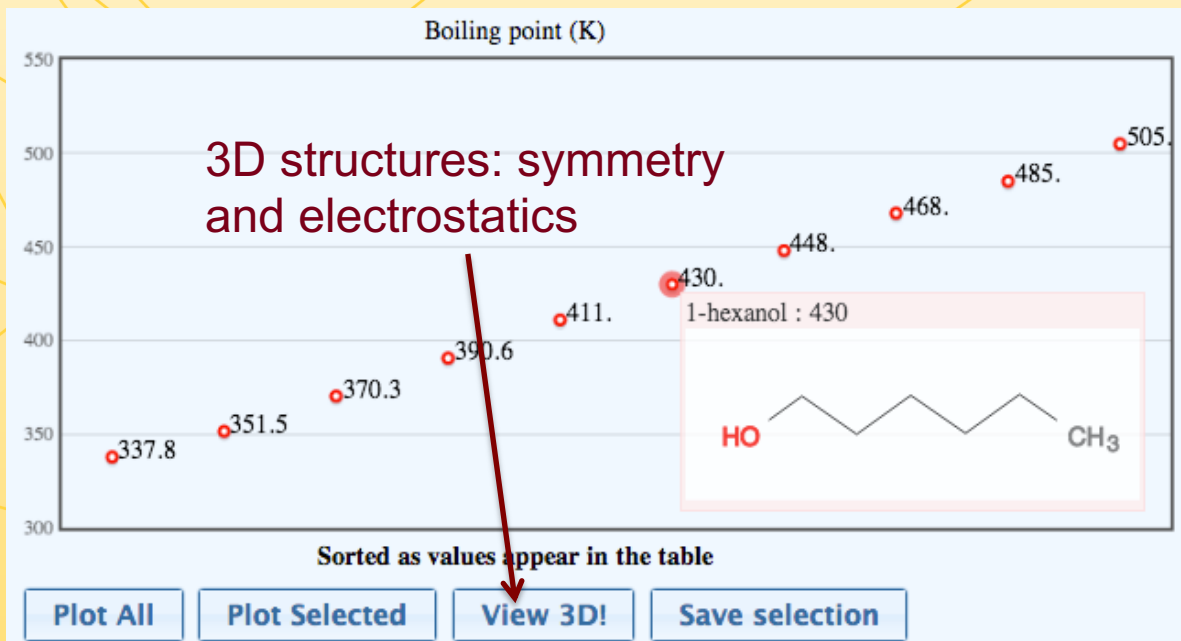


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<http://chemdata.r.umn.edu>

Order and filter

3D structures: symmetry and electrostatics



Select all Select None Click to select rows

Show 10 entries

Search:

Name	Image	Mol. Wt.	Numb. Carbons	Labels	Boiling point (K)
methanol	<chem>CO</chem>	32.0	1	alcohols, linear	337.8
ethanol	<chem>CCO</chem>	46.1	2	alcohols, linear	351.5
propanol	<chem>CCCO</chem>	60.1	3	alcohols, linear	370.3
1-butanol	<chem>CCCCO</chem>	74.1	4	alcohols, linear	390.6
1-pentanol	<chem>CCCCCO</chem>	88.1	5	alcohols, linear	411.
1-		102.2	6	alcohols,	430.

Fun

Molecular Properties

- ☐ Alkanes
- ☒ Alcohols
- ☐ Aldehydes
- ☐ Haloalkanes
- ☐ Ethers
- ☐ Carboxylic

Phase Change

- ☒ Boiling point (K)
- ☐ Melting point (K)
- ☐ Heat capacity liq(J/mol*K)
- ☐ Heat capacity gas(J/mol*K)
- ☐ $\Delta H_{\text{vaporiz}}$ (kJ/mol)
- ☐ ΔH_{fusion} (kJ/mol)

Reactions

- ☐ ΔH_{form} gas (kJ/mol)
- ☐ ΔH_{form} liq (kJ/mol)
- ☐ ΔH_{comb} gas (kJ/mol)
- ☐ ΔH_{comb} liq (kJ/mol)

Solubility

- ☐ Solubility
- Henry's K (mol/kg*bar)

Select func. groups and properties.
Hundreds of compounds.

Boiling point of molecules

Level 1

Remember
Intermol Forc.

Level 2-3

Mass or dipole?
 CH_xF_y

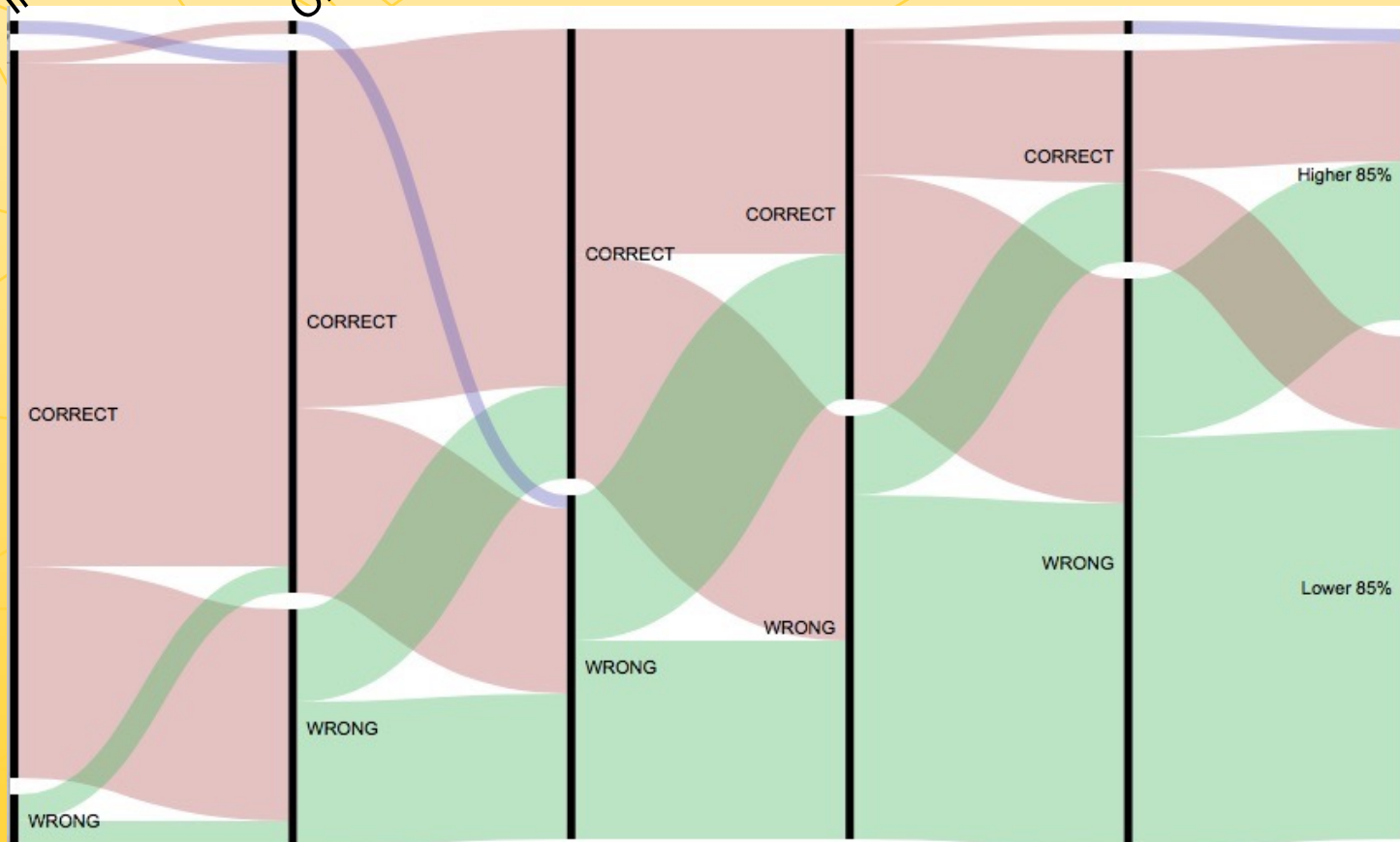
Recognize
good CVS

Level 4

Build CVS
Mass role

Build CVS
IMF role

Final course
grade



BoSCO

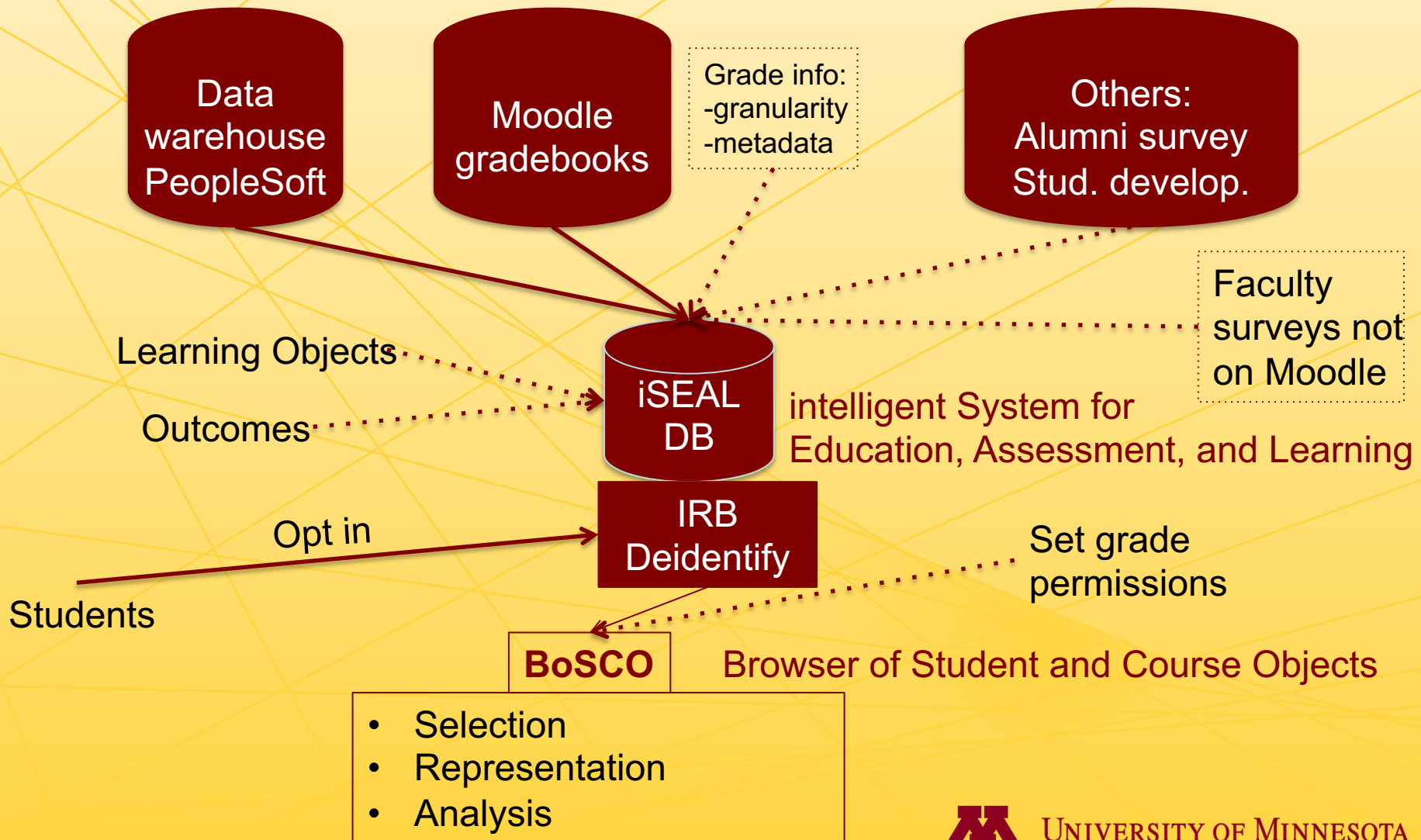
Browser of Student and Course Objects

How does student performance in one grade may predict how they are performing in another grade?

Give me the data!



Data storage, access and display



BoSCO: type of representations

- Histograms (bar graph), Scatter plot, Timeline, Correlation matrix

BoSCO
A Browser of Student and Course Objects

	Chem2331;Fall 2010	Chem2331;Fall 2011	Chem2331;Fall 2012	Chem2331;Fall 2013	Chem2331;Fall 2014	Chem2333;Spring 2011	Chem2333;Spring 2012	Chem2333;Spring 2013	Chem2333;Spring 2014	Bioc3321;Spring 2012	Bioc3321;Spring 2013	Bioc3321;Spring 2014
Chem2331;Fall 2010	1.0000	0	0	0	0	0.7439	0	0	0	0.5260	0	0
Chem2331;Fall 2011	0	1.0000	0	0	0	0	0.6090	0	0	0	0.2240	0
Chem2331;Fall 2012	0	0	1.0000	0	0	0	0	0.7497	0.4491	0	0	0.6597
Chem2331;Fall 2013	0	0	0	1.0000	0	0	0	0	0.6169	0	0	0
Chem2331;Fall 2014	0	0	0	0	1.0000	0	0	0	0	0	0	0
Chem2333;Spring 2011	0.7439	0	0	0	0	1.0000	0	0	0	0.6353	0	0
Chem2333;Spring 2012	0	0.6090	0	0	0	0	1.0000	0	0	0	0.5729	0
Chem2333;Spring 2013	0	0	0.7497	0	0	0	0	1.0000	0	0	0	0.6004
Chem2333;Spring 2014	0	0	0.4491	0.6169	0	0	0	0	1.0000	0	0	0
Bioc3321;Spring 2012	0.5260	0	0	0	0	0.6353	0	0	0	1.0000	0	0
Bioc3321;Spring 2013	0	0.2240	0	0	0	0	0.5729	0	0	0	1.0000	0
Bioc3321;Spring 2014	0	0	0.6597	0	0	0	0	0.6004	0	0	0	1.0000

Is Homework useful?

- Is there any correlation between homework performance and other assignments. Should there be any? How about meta-grades?

X	Y
Homework grade	Final grade
# of attempts	Exams grade
Grade at first attempt	Type B questions
Time taken	Type C questions

<http://chem.r.umn.edu/bosco/index.php?key=53d15676a19554ae83e7d99f77b28423>

