Assessing Students' Critical Thinking Skills

Data Dialogue – February 11

Overview

- Background: Critical Thinking Assessment

- Collegiate Learning Assessment Test (CLA)

- Critical Thinking Assessment Test (CAT)

- CAT Results 2013 – 2018

- Where do we go from here?

DU University-wide Student Learning Goals

Catholic-Dominican *Ethos*
Communication Skills
Critical Thinking Skills
Global Citizenship
Knowledge: Breadth and Depth
Integrative/Interdisciplinary Inquiry
Research and Scholarship
Social Responsibility/Civic Engagement

Critical Thinking Skills

Students will develop the necessary skills to think critically.

Operational definition: "to think critically" is defined as the intellectual process of analyzing, applying, synthesizing and/or evaluating information collected and/or generated through observation, experience, reflection, reasoning, or communication so as to reach an answer, make a prediction, or draw a conclusion.
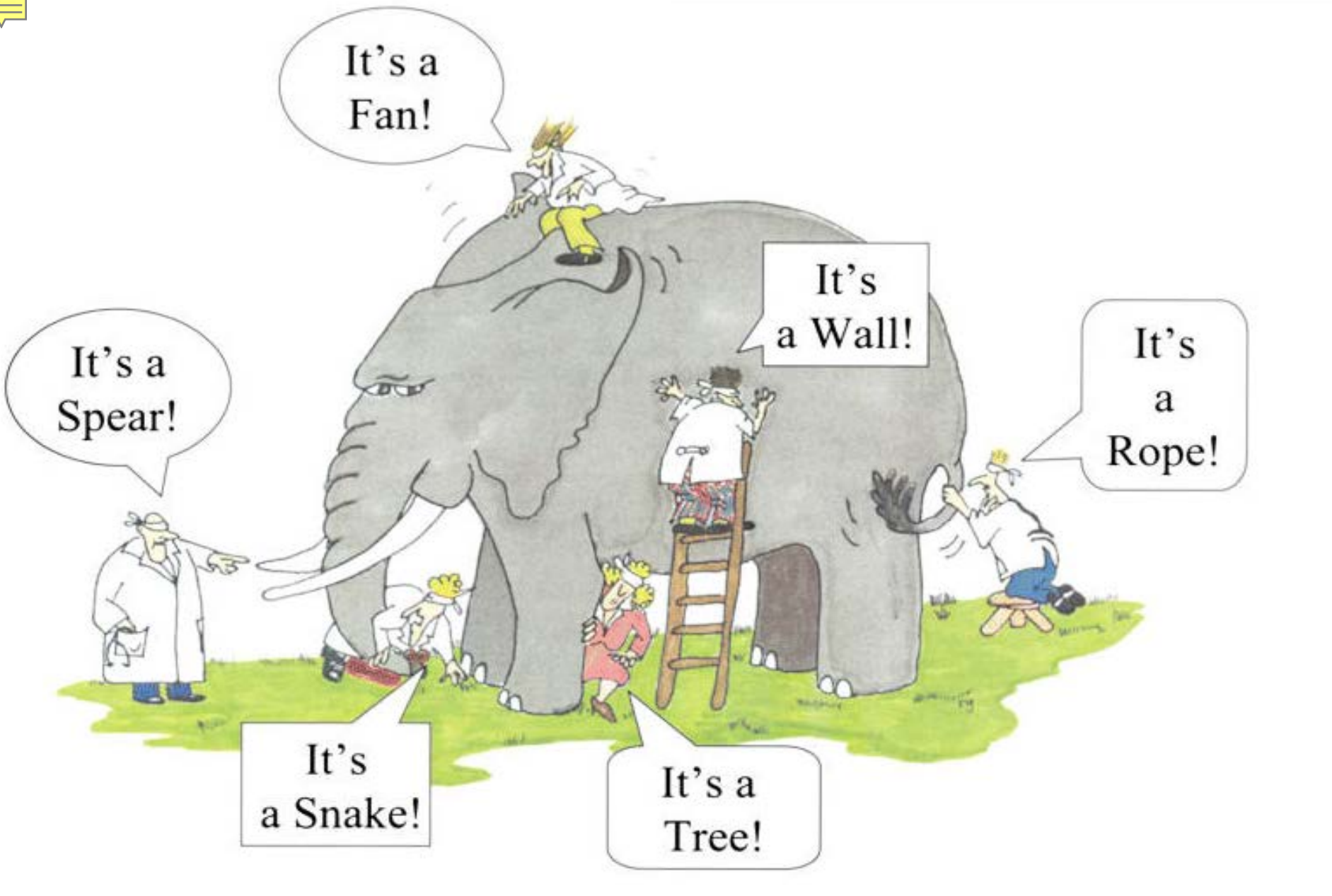
CLA

- Used each year at DU from 2008 – 2011
- Online test: open-ended prompts
- 90 minute assessment
- Scored off-campus by CLA
- Emphasis – Institutional context
- Individual student results available upon request

CLA - Tasks

Performance Task

– Analyzing complex, realistic scenarios

Make-an-Argument

– Writing a persuasive essay

Critique-an-Argument

– Critiquing written arguments

CLA - Measures

- Analytical Reasoning and Evaluation

- Problem Solving

- Writing Effectiveness

- Writing Mechanics

Sample CLA Performance Task

You advise Pat Williams, the president of DynaTech, a company that makes precision electronic instruments and navigational equipment. Sally Evans, a member of DynaTech's sales force, recommended that DynaTech buy a small private plane (a SwiftAir 235) that she and other members of the sales force could use to visit customers. Pat was about to approve the purchase when there was an accident involving a SwiftAir 235.

Your document library contains the following materials:
1. Newspaper article about the accident
2. Federal Accident Report on in-flight breakups in single-engine planes
3. Internal Correspondence (Pat's e-mail to you & Sally's e-mail to Pat)
4. Charts relating to SwiftAir's performance characteristics
5. Excerpt from magazine article comparing SwiftAir 235 to similar planes
6. Pictures and descriptions of SwiftAir Models 180 and 235

Sample Questions: Do the available data tend to support or refute the claim that the type of wing on the SwiftAir 235 leads to more in-flight breakups? What is the basis for your conclusion? What other factors might have contributed to the accident and should be taken into account? What is your preliminary recommendation about whether or not DynaTech should buy the plane and what is the basis for this recommendation?

CLA: General Finding

On average, Dominican seniors outscored the freshmen (~ 9%) on the CLA

These gains were lower than what one would expect given the performance of the freshmen class relative to freshmen at other institutions.

CLA → CAT: Why?

- Logistic issues with computer/computer lab resources

- CLA is a 90 minute assessment – cannot be administered during most classes

- Faculty removed from the CLA assessment

- CLA did not offer a smooth path to curricular revision

CAT

- Used at DU from 2013 – present
- Paper-and-pencil test
- Mixture of prompts (15 total)
- Can be administered in a 50-75 minute time frame
- Scored in-house by DU faculty
- Emphasis – Institutional context
- Individual student results available

DOMINICAN UNIVERSITY
Where Learning Demands More

CAT: Constructs Measured

Evaluating and Interpret Information

- Separate factual information from inferences.
- Interpret numerical relationships in graphs.
- Understand the limitations of correlational data.
- Evaluate evidence and identify inappropriate conclusions.

Problem Solving

- Separate relevant from irrelevant information.
- Integrate information to solve problems.
- Learn and apply new information.
- Use mathematical skills to solve real-world problems.

CAT: Constructs Measured (cont'd)

Creative Thinking
- Identify alternative interpretations for data or observations.
- Identify new information that might support or contradict a hypothesis.
- Explain how new information can change a problem.

Communication
- Communicate ideas effectively.

Sample Disclosed Question

A scientist working at a government agency believes that an ingredient commonly used in bread causes criminal behavior. To support his theory the scientist notes the following evidence.

- 99.9% of the people who committed crimes consumed bread prior to committing crimes.
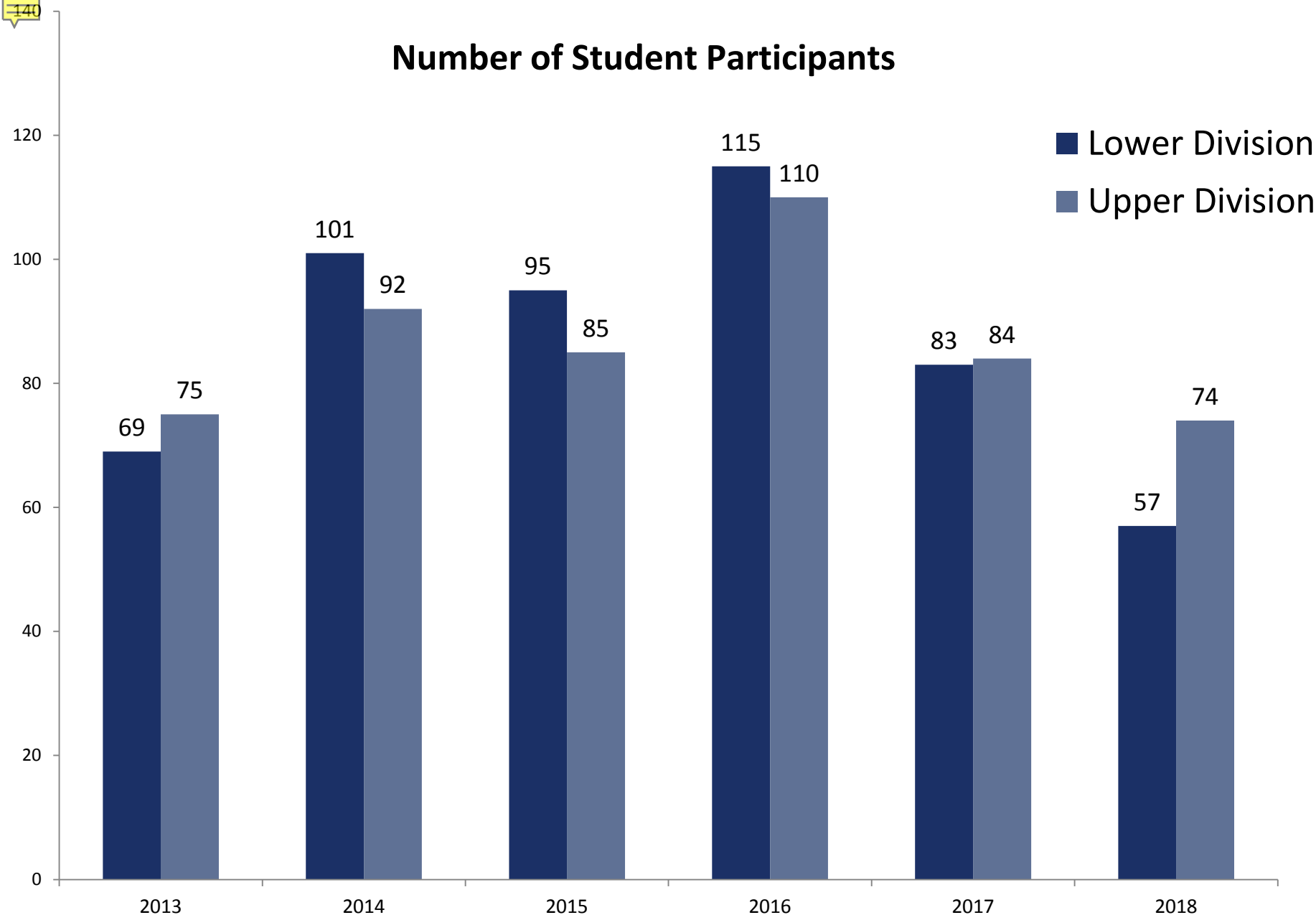- Crime rates are extremely low in areas where bread is not consumed.

Do the data presented by the scientist strongly support their theory? Yes ____ No____

Are there other explanations for the data besides the scientist's theory? If so, describe.

_____

What kind of additional information or evidence would support the scientist's theory?
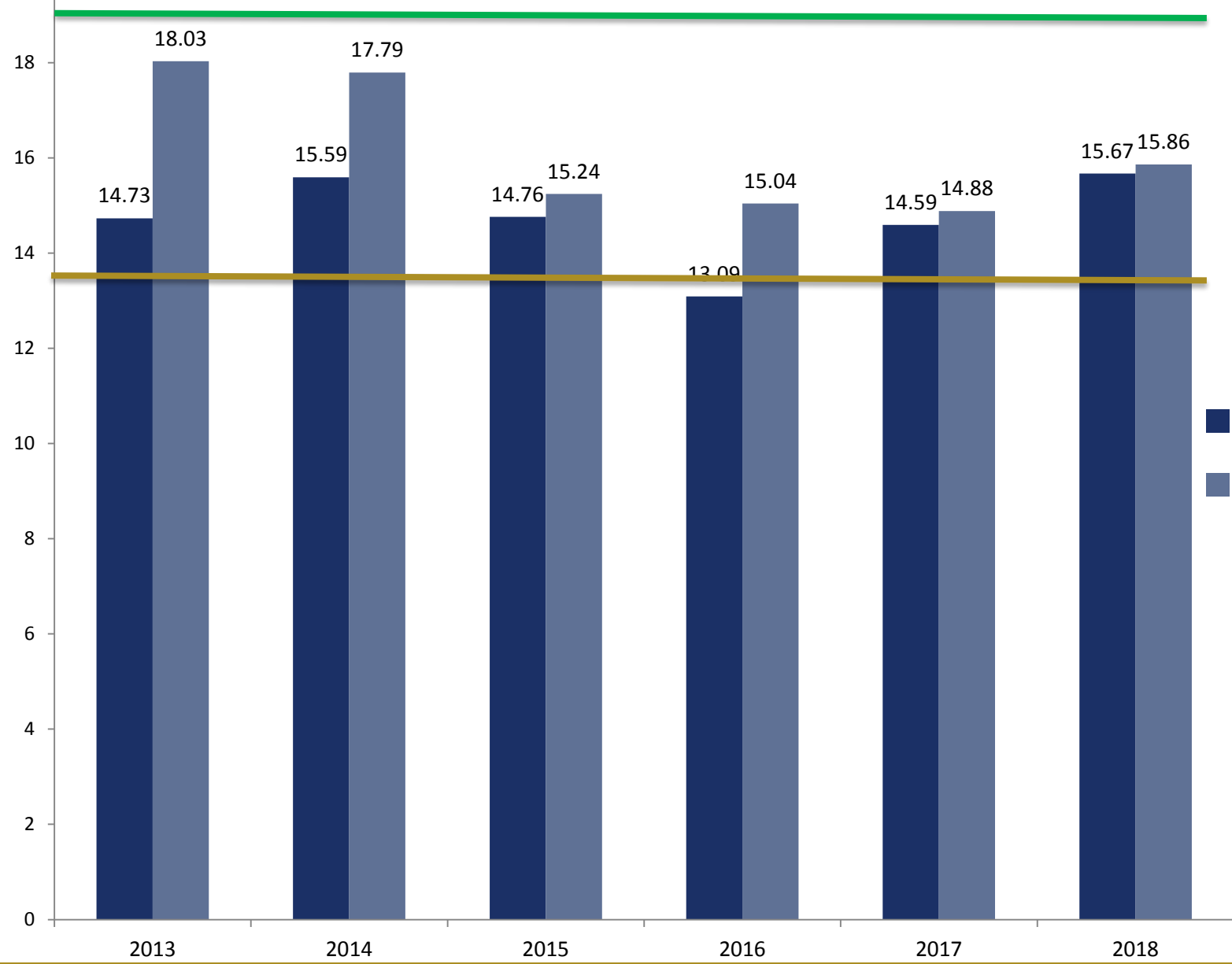
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Number of Student Participants

Overall Group Mean 2013 – 2018 (38 possible pts.)

Same Class Comparison

Chart comparing Lower Division and Upper Division values:

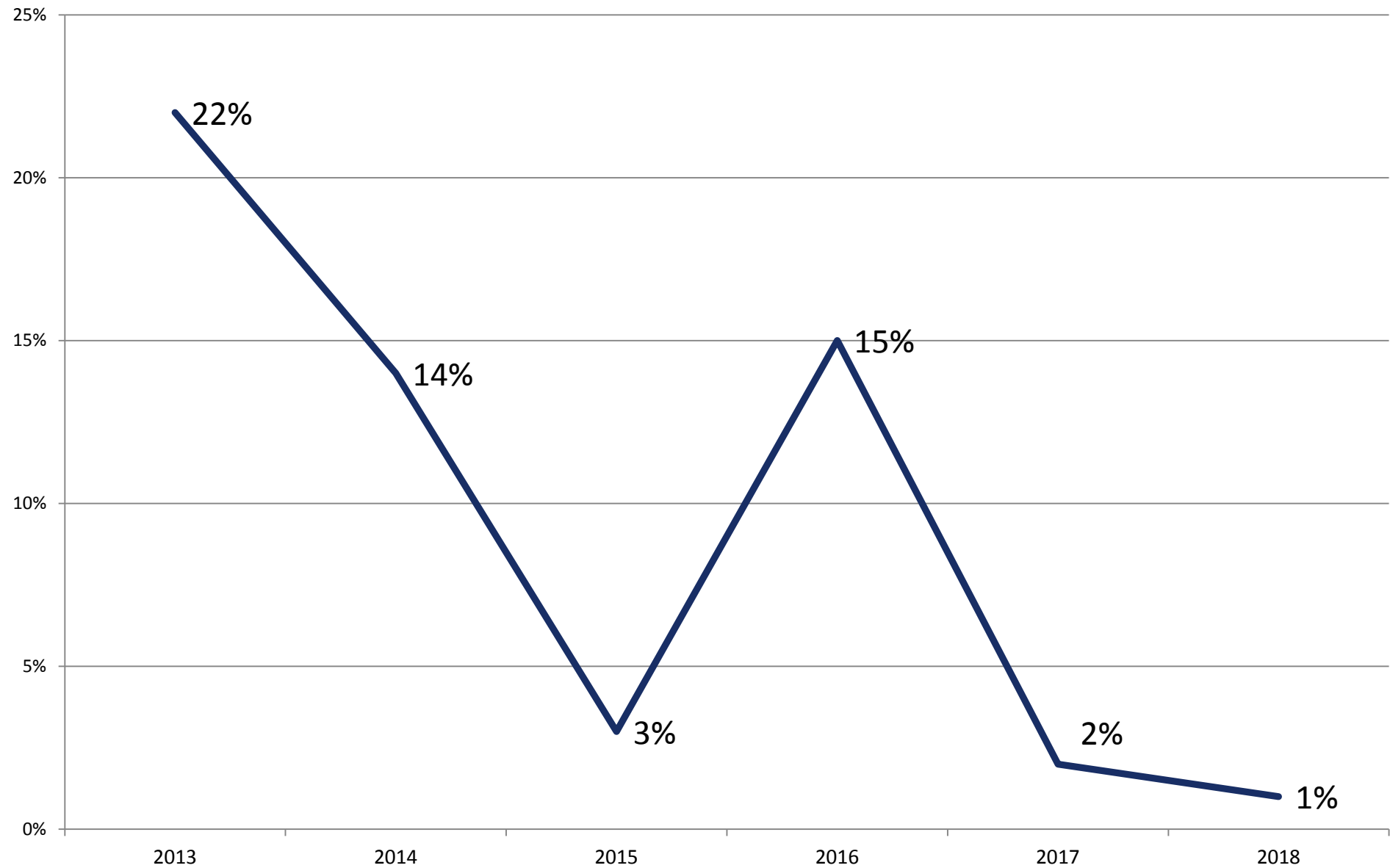| Year	Lower Division	Upper Division
2013	14.73	
2016		15.04
2014	15.59	
2017		14.88
2015	14.76	
2018		15.86
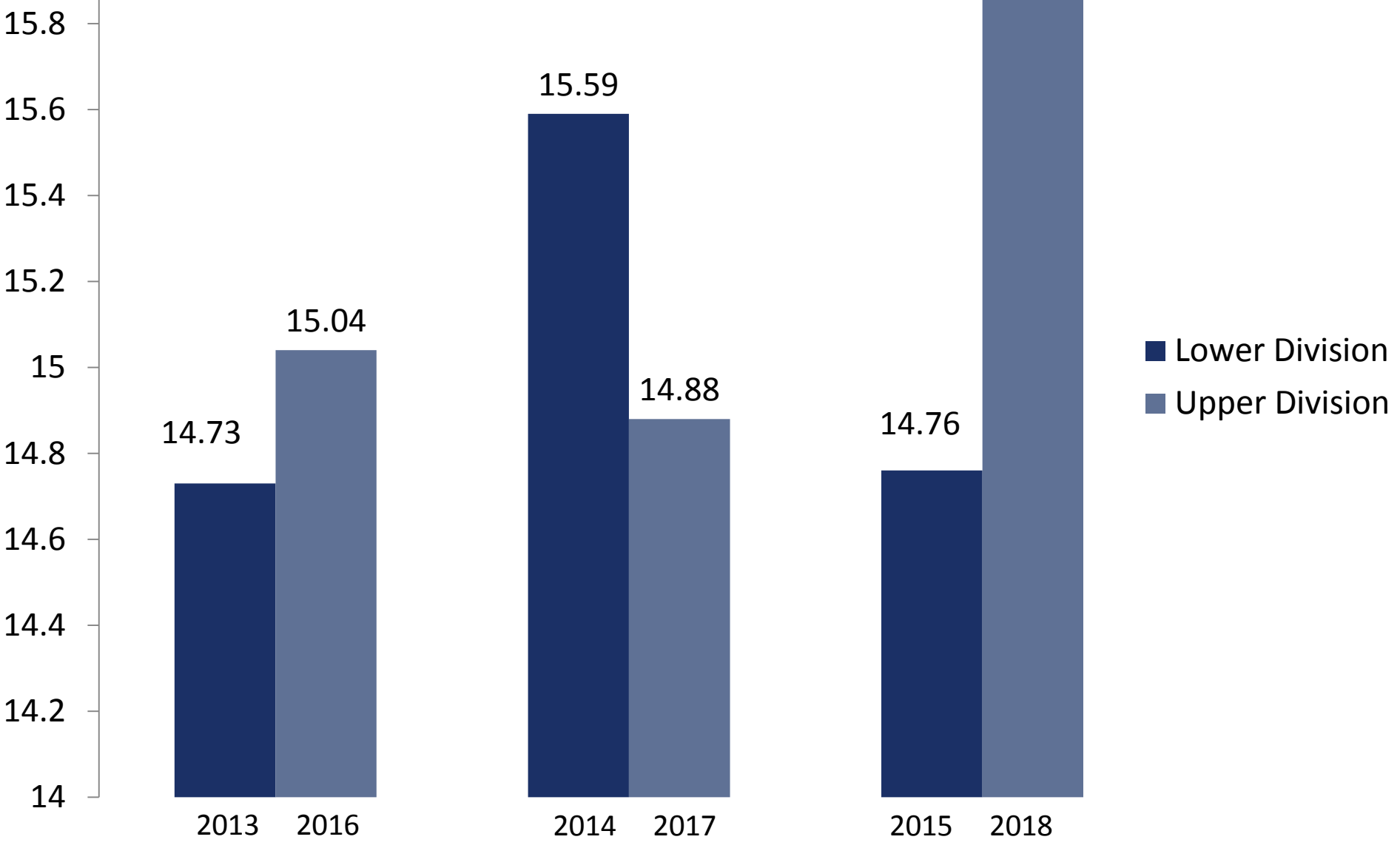
CAT: General Findings

- Our lower division students (predominantly freshmen) consistently outperform their comparison average.

- Our upper division students (predominantly seniors) consistently score below their comparison average.

- DU upper division students consistently outscore the DU lower division students. However, . . .

- Senior CAT averages have been trending lower over time.

- The gap between the lower division and upper division students has been narrowing over time.

Percent Difference between Lower Division and Upper Division in CAT Score

	LOWER DIVISION:	Avg. % of Attainable Points	Evaluate and Interpret Info.	Problem Solving	Creative Thinking	Effective Comm.
Q15	Explain how changes in a real-world problem situation might affect the solution.	17%		✓	✓	✓
Q3	Provide alternative explanations for a pattern of results that has many possible causes.	22%			✓	✓
Q4	Identify additional information needed to evaluate a hypothesis.	22%		✓	✓	✓
Q7	Identify additional information needed to evaluate a hypothesis.	24%		✓	✓	✓
Q2	Evaluate how strongly correlational-type data support a hypothesis.	28%	✓			✓
Q13	Identify suitable solutions for a real-world problem using relevant information.	29%	✓	✓		
Q9	Provide relevant alternative interpretations for a specific set of results.	31%			✓	✓
Q14	Identify and explain the best solution for a real-world problem using relevant information.	41%	✓	✓		✓
Q11	Use and apply relevant information to evaluate a problem.	43%	✓	✓		✓
Q6	Provide alternative explanations for spurious associations.	44%			✓	✓
Q1	Summarize the pattern of results in a graph without making in appropriate inferences.	57%	✓			
Q8	Determine whether an invited inference is supported by specific information.	57%	✓			
Q5	Evaluate whether spurious information strongly supports a hypothesis	68%	✓			
Q12	Use basic mathematical skills to help solve a real-world problem.	75%		✓		
Q10	Separate relevant from irrelevant information when solving a real-world problem	76%	✓	✓		

		Avg. % of Attainable Points	Evaluate and Interpret Info.	Problem Solving	Creative Thinking	Effective Comm.
	LOWER DIVISION:					
Q15	Explain how changes in a real-world problem situation might affect the solution.	17%		✓	✓	✓
Q3	Provide alternative explanations for a pattern of results that has many possible causes.	22%			✓	✓
Q4	Identify additional information needed to evaluate a hypothesis.	22%		✓	✓	✓
Q7	Identify additional information needed to evaluate a hypothesis.	24%		✓	✓	✓
Q2	Evaluate how strongly correlational-type data support a hypothesis.	28%	✓			✓
Q13	Identify suitable solutions for a real-world problem using relevant information.	29%	✓	✓		
Q9	Provide relevant alternative interpretations for a specific set of results.	31%			✓	✓
Q14	Identify and explain the best solution for a real-world problem using relevant information.	41%	✓	✓		✓

	UPPER DIVISION:	Avg. % of Attainable Points	Evaluate and Interpret Info.	Problem Solving	Creative Thinking	Effective Comm.
Q7	Identify additional information needed to evaluate a hypothesis.	23%		✓	✓	✓
Q4	Identify additional information needed to evaluate a hypothesis.	26%		✓	✓	✓
Q3	Provide alternative explanations for a pattern of results that has many possible causes.	27%			✓	✓
Q15	Explain how changes in a real-world problem situation might affect the solution.	27%		✓	✓	✓
Q13	Identify suitable solutions for a real-world problem using relevant information.	32%	✓	✓		
Q2	Evaluate how strongly correlational-type data support a hypothesis.	34%	✓			✓
Q9	Provide relevant alternative interpretations for a specific set of results.	36%			✓	✓
Q14	Identify and explain the best solution for a real-world problem using relevant information.	42%	✓	✓		✓
Q6	Provide alternative explanations for spurious associations.	46%			✓	✓
Q11	Use and apply relevant information to evaluate a problem.	48%	✓	✓		✓
Q1	Summarize the pattern of results in a graph without making in appropriate inferences.	60%	✓			
Q8	Determine whether an invited inference is supported by specific information.	62%	✓			
Q5	Evaluate whether spurious information strongly supports a hypothesis.	74%	✓			
Q10	Separate relevant from irrelevant information when solving a real-world problem.	74%	✓	✓		
Q12	Use basic mathematical skills to help solve a real-world problem.	77%		✓		

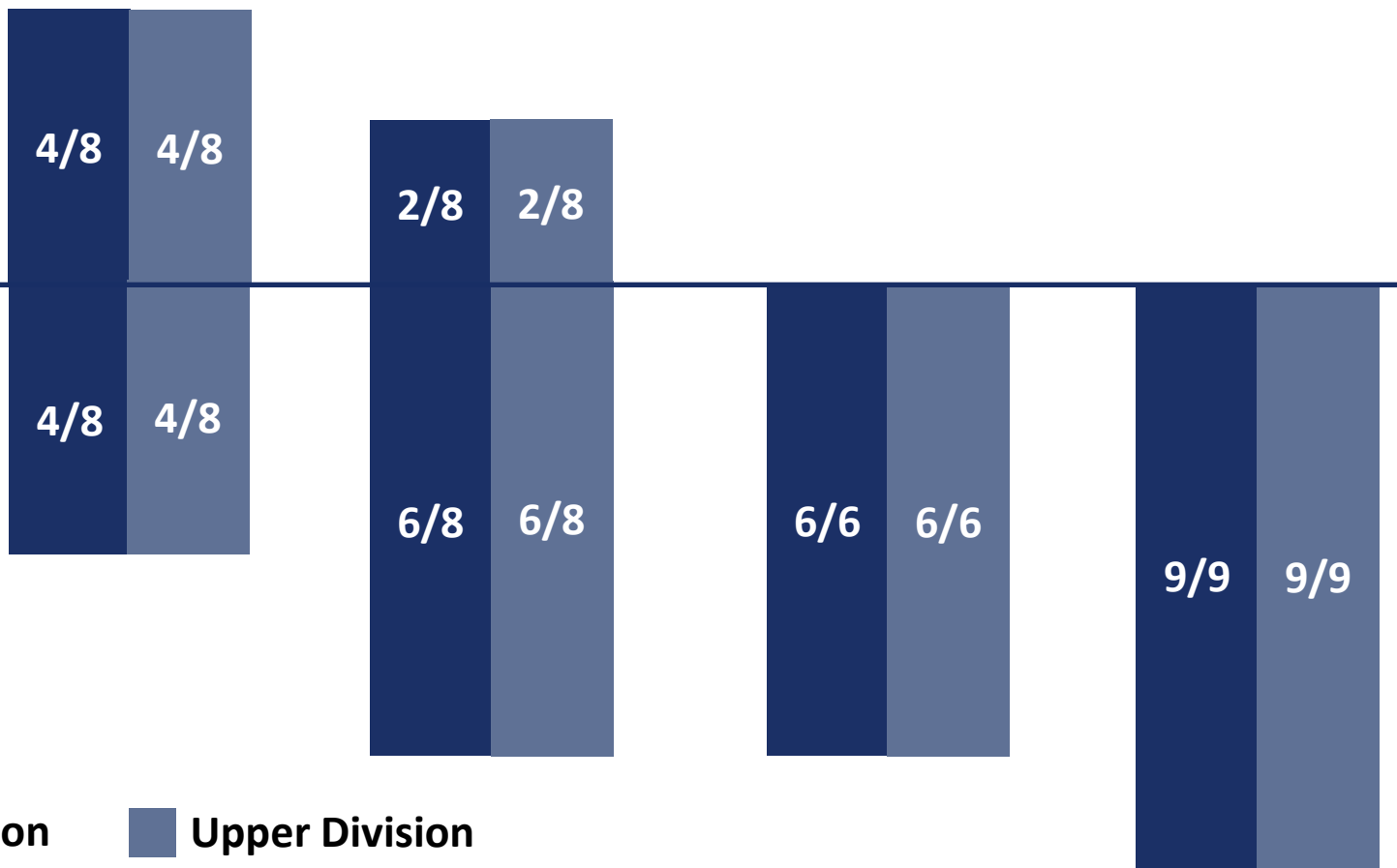|	UPPER DIVISION:	Avg. % of Attainable Points	Evaluate and Interpret Info.	Problem Solving	Creative Thinking	Effective Comm.
Q7	Identify additional information needed to evaluate a hypothesis.	23%		✓	✓	✓
Q4	Identify additional information needed to evaluate a hypothesis.	26%		✓	✓	✓
Q3	Provide alternative explanations for a pattern of results that has many possible causes.	27%			✓	✓
Q15	Explain how changes in a real-world problem situation might affect the solution.	27%		✓	✓	✓
Q13	Identify suitable solutions for a real-world problem using relevant information.	32%	✓	✓		
Q2	Evaluate how strongly correlational-type data support a hypothesis.	34%	✓			✓
Q9	Provide relevant alternative interpretations for a specific set of results.	36%			✓	✓
Q14	Identify and explain the best solution for a real-world problem using relevant information.	42%	✓	✓		✓

Skill Assessed by CAT Question		UPPER						
	PTs	2013	2014	2015	2016	2017	2018	Nat. Comp.
Q1 Summarize the pattern of results in a graph without making inappropriate inferences.	1	0.60	0.70	0.56	0.68	0.54	0.56	0.67
Q2 Evaluate how strongly correlational-type data supports a hypothesis.	3	1.20	1.09	0.78	1.05	0.80	1.19	1.21
Q3 Provide alternative explanations for a pattern of results that has many possible causes.	3	1.04	0.87	0.82	0.70	0.79	0.71	1.35
Q4 Identify additional information needed to evaluate a hypothesis.	4	1.50	1.28	0.84	0.70	1.17	0.69	1.41
Q5 Evaluate whether spurious information strongly supports a hypothesis.	1	0.72	0.73	0.76	0.77	0.69	0.71	0.73
Q6 Provide alternative explanations for spurious associations.	3	1.35	1.55	1.44	1.24	1.44	1.23	1.56
Q7 Identify additional information needed to evaluate a hypothesis.	2	0.63	0.58	0.41	0.37	0.31	0.38	0.82
Q8 Determine whether an invited inference is supported by specific information	1	0.68	0.65	0.56	0.65	0.54	0.71	0.68
Q9 Provide relevant alternative interpretations for a specific set of results.	2	0.96	0.73	0.73	0.79	0.52	0.65	0.93
Q10 Separate relevant from irrelevant information when solving real-world problems.	4	2.96	3.12	2.79	2.84	3.04	2.88	3.14
Q11 Use and apply relevant information to evaluate a problem.	2	1.03	1.25	0.74	0.85	1.06	0.79	1.11
Q12 Use basic mathematical skills to help solve a real-world problem.	1	0.77	0.78	0.73	0.78	0.73	0.81	0.82
Q13 Identify suitable solutions for a real-world problem using relevant information.	3	1.20	1.03	0.86	0.92	0.87	0.90	1.18
Q14 Identify and explain the best solution for a real-world problem using relevant information.	5	2.21	2.27	2.36	2.05	1.93	1.81	2.29
Q15 Explain how changes in a real-world problem	3	1.19	1.21	0.87	0.66	0.48	0.56	1.15
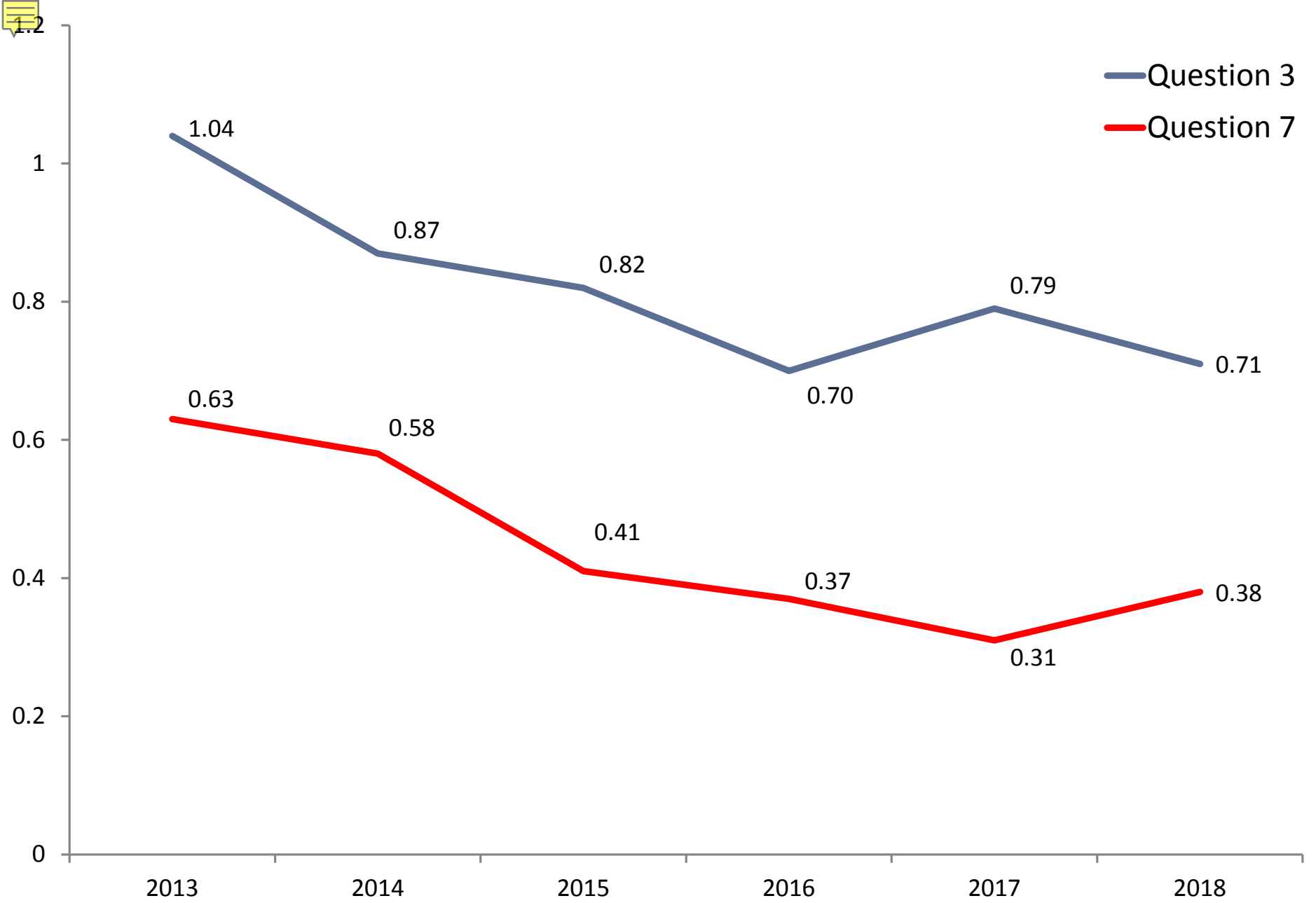
Using CAT Apps for curricular improvements

Course embedded interventions

CAT sponsored workshops/faculty development

    Biology

    English

    Mathematics

Where do we go from here?

Upcoming Spring 2019
DATA DIALOGUES

Graduating Student Survey

Global Citizenship Survey

See the full Data Dialogue schedule on our OIE website