



# THE NATIONAL NUMERACY NETWORK

## The QLRA Project

Eric Gaze, Bowdoin College  
Joint Math Meetings  
Baltimore, MD  
January 15, 2014



# The QLR Assessment Project

- NSF TUES: Transforming Undergraduate Education in STEM, DUE 1140562
- Type I, 2 year pilot project
  - Create QLRA instrument
  - Create Website for Administering Test
  - Establish national baseline of QLR scores
- Combined Bowdoin, Colby-Sawyer, and Wellesley exams
- 2012 Mean 13.44 out of 23 (58.4%;  $sd = 5.35$ )
- 2013 Mean 9.22 out of 20 (46.1%;  $sd = 5.02$ )
- Co-PI's:
  - Semra Kilic-Bahi Colby Sawyer College
  - Linda Misener Southern Maine Community College

Note: the 2013 test was reduced to 20 questions.

# The 2013 QLR Assessment Project



Institution	2012 N	2012 %	2013 N	2013 %
Bates	115	6.9	110	5.1
Bowdoin	100	6.0	100	4.6
Carthage	—	—	112	5.2
Carleton	53	3.2	—	—
Colby-Sawyer	64	3.9	695	32.0
Central Washington	270	16.3	117	5.4
Edmonds CC	79	4.8	153	7.0
Holy Cross	652	39.3	457	21.0
Kenyon	—	—	100	4.6
Lansing CC	130	7.8	—	—
Lewis and Clark	—	—	126	5.8
Southern Maine CC	105	6.3	120	5.5
Wellesley	91	5.5	83	3.8
<b>Total</b>	<b>1659</b>	<b>100.0</b>	<b>2172</b>	<b>100.0</b>

# The 2013 QLR Assessment Project

2013 QLRA Participating Institutions	
1	Bates College, ME
2	Borough of Manhattan Community College, NY
3	Bowdoin College, ME
4	Carthage College, WI
5	Central Piedmont Community College, NC
6	Central Washington University, WA
7	Colby-Sawyer College, NH
8	The College of the Holy Cross, MA
9	Edmonds Community College, WA
10	Ivy Tech Community College, IN
11	Kenyon College, PA
12	Lansing Community College, MI
13	Lewis and Clark College, OR
14	Northern Arizona University, AZ
15	Oberlin College, OH
16	Southern Maine Community College, ME
17	Southwestern Community College, NC
18	University of Southern Maine, ME
19	University of Southern Mississippi, MS
20	Wellesley College, MA



We have 9 schools already signed on to use the online test site for 2014.

# The QLR Assessment Project



Institution Type	2012 Mean %	2012 Std. Dev.	2013 Mean %	2013 Std. Dev.
2-Year	44.7	23.4	39.3	20.2
Selective 4-year	66.4	20.0	59.7	22.8
Non-selective 4-year	47.2	21.6	30.1	17.9
Total	58.4	23.3	45.6	24.7

Note: the significant drop in mean score due to increase in non-selective school participation.

Institution Type	2012 N	2012 %	2013 N	2013 %
2-Year	314	18.9	273	12.6
Non-selective 4-year	334	20.1	811	37.3
Selective 4-year	1011	60.9	1088	50.1
Total	1659	100.0	2172	100.0

# The QLR Assessment Project



Year	N	Min (%)	Median (%)	Max (%)	Mean (%)	Std. Dev. (%)
2012	1659	4.3	<b>60.9</b>	100.0	<b>58.4</b>	23.2
2013	2172	0.0	<b>40.0</b>	100.0	<b>46.1</b>	25.1

		2012 Data			
Gender	N	%	Mean %	Median %	Std. Dev.
Male	529	50.2	62.9	65.2	22.7
Female	524	<b>49.8</b>	57.1	56.5	22.9
<b>Total</b>	<b>1053</b>	<b>100.0</b>			

The significant difference in gender means due to more females from non-selective schools.

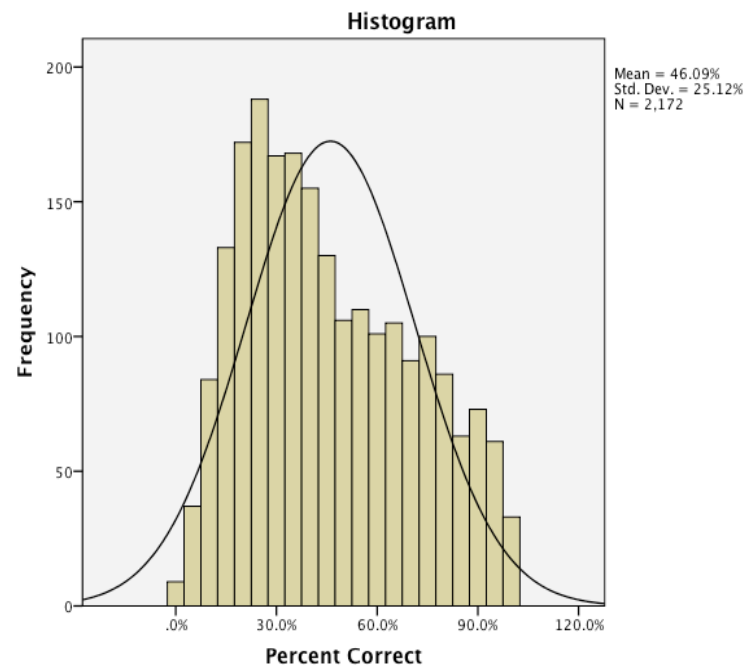
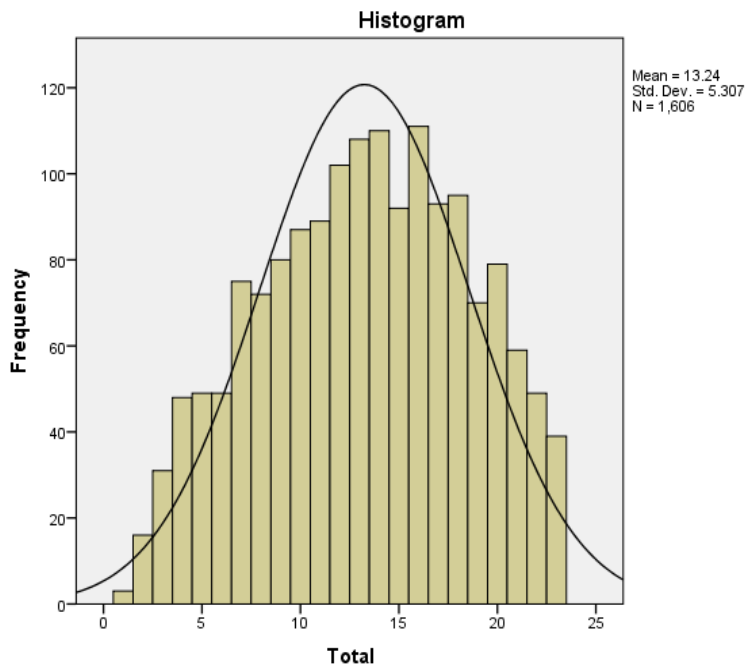
		2013 Data			
Gender	N	%	Mean %	Median %	Std. Dev.
Male	732	39.7	49.6	50	23.9
Female	1111	<b>60.3</b>	41.2	35	23.8
<b>Total</b>	<b>1843</b>	<b>100.0</b>			

# The QLR Assessment Project



2012 Test Data

2013 Test Data



Again you can see influence of non-selective school participation rates.

# Math 050: Quantitative Reasoning

- Pre-Post Assessments

<b>Math 50: QR Spring 2011</b>			
	Pre-Qzscore	Post-Qzscore	Total Improvement
<b>Mean</b>	-1.219	-0.253	<b>0.966</b>
<b>StDev</b>	0.905	0.913	
<b>Math 50: QR Fall 2011</b>			
	Pre-Qzscore	Post-Qzscore	Total Improvement
<b>Mean</b>	-1.337	-0.210	<b>1.127</b>
<b>StDev</b>	0.670	0.913	
<b>Math 50: QR Fall 2012</b>			
	Pre-Qzscore	Post-Qzscore	Total Improvement
<b>Mean</b>	-1.45	-0.230	<b>0.916</b>
<b>StDev</b>	0.694	0.607	





# The QLRA 13

- 13 questions identical to the Bowdoin Q-exam questions
  - #2, 7, 8, 9, 13, 15, 16, 17, 18, 19, 21, 22, 23
- Bowdoin 2012 Q-exam 30 questions (N = 497)

	Correl	Mean QLRA 13		STDEV QLRA 13	
Total QLRA	0.959	6.82	52.5%	3.315	25.5%
Bowdoin	0.913	9.02	69.4%	2.72	20.9%



# The Bowdoin QR Exam

- 30 question entrance exam used for advising
  - Under 50% on Bowdoin Q-exam criteria for Math 050 (N = 50)
- Lessons Learned
  - Replace procedural, algorithmic questions with more involved reasoning, critical thinking questions.
  - Ask students to interpret tables and charts rather than doing it for them.
  - Focus on quantitative literacy, using numbers in meaningful sentences rather than just computation.
  - Ask students to postulate possible explanations for statistics rather than traditional logic games.



# The Bowdoin QR Exam

- 30 question entrance exam used for advising
  - Under 50% on Bowdoin Q-exam criteria for Math 050 (N = 50)
- Significant predictor of GPA (N = 3,000)
  - Cumulative GPA  $r = 0.39$
  - MCSR GPA  $r = 0.48$
- Strongly correlated with 1<sup>st</sup> year Cum GPA  $r = 0.48$
- Multivariate Regression Models ( $R^2 = 0.30$  Cum GPA and  $R^2 = 0.36$  MCSR GPA)



- M
- R
- T

Holding All Other Variables Constant		
	Q-score 30%	Q-score 80%
Cum GPA	3.2	3.5
MCSR GPA	2.7	3.5

Cum GPA and

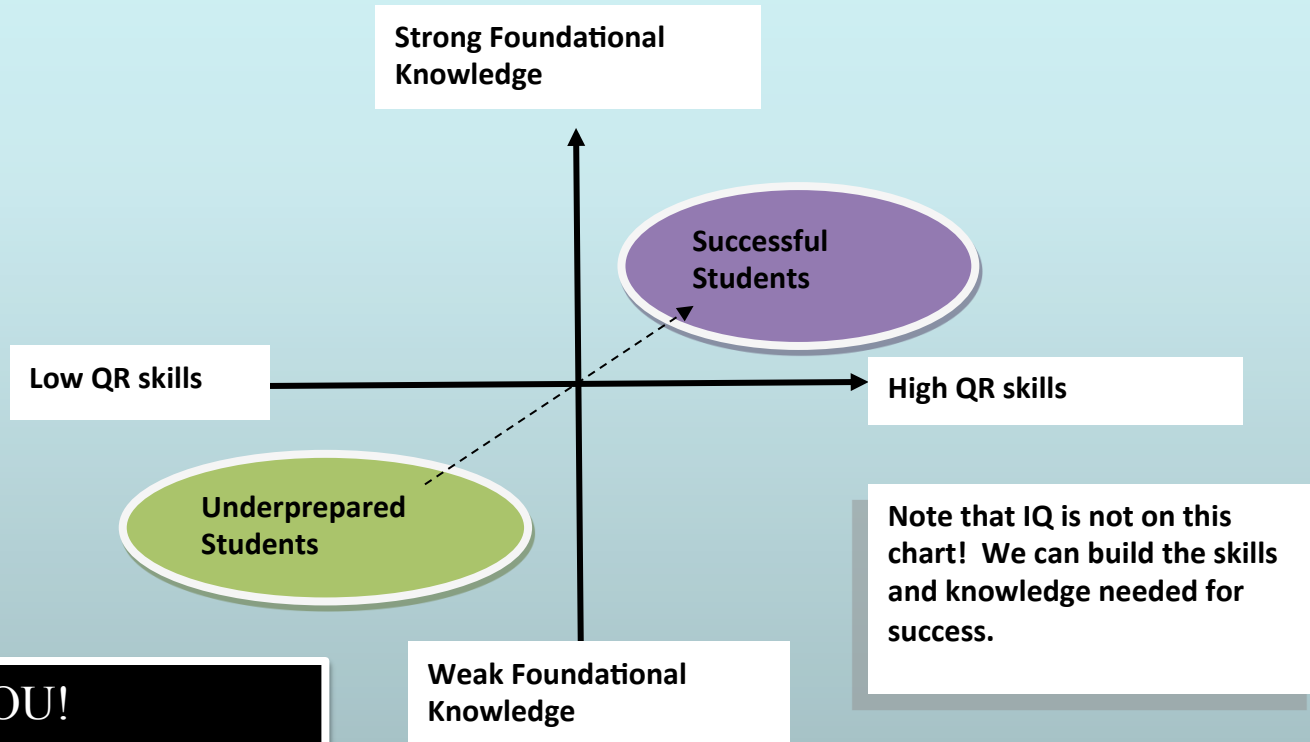
ference in GPA

associated with a 10 percentage point increase in respective aptitude test, with **all** other variables in model held constant.

Cumulative GPA Multivariate Regression Coefficients		
Math SAT	Q-score	Verbal SAT
0.0345	0.0603	0.0857
MCSR GPA Multivariate Regression Coefficients		
Math SAT	Q-score	Verbal SAT
0.1711	0.1599	0.0357

# Scaffolding Student Success

- Math 1050: QR is an ENTRY point
- Math 1050: QR as a foundation for Calculus and Social Science
- Math 1050: QR is an EXIT point
- Future Work



**THANK YOU!**  
Questions?  
[egaze@bowdoin.edu](mailto:egaze@bowdoin.edu)