

Measurements for Learning and Practice: The Revised Calculus Concept Inventory (RCCI)



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“We propose here the development of a revised calculus concept inventory (RCCI) that assesses conceptual knowledge without the complication of unnecessary mathematical notation. The RCCI will be informed by current research and prior concept inventory efforts, including the Calculus Concept Inventory (CCI; Epstein & Yang, 2004), and Calculus 1 Concept Inventory (C1CI; Thompson & Ashbrook, 2016), and designed to match current calculus needs. Through this work, we will establish a firm evidence base to support the RCCI’s psychometric properties.”

WHAT IS A CONCEPT INVENTORY?



Multiple Choice Assessment,
Pre and Post Administration



Designed to measure conceptual understanding
as distinct from procedural fluency, while
minimizing cumbersome technical language

Research Questions

1. How can the CCI and C1CI be merged, revised and/or extended to better capture conceptual changes in students' pre and post calculus knowledge?
2. What alterations or updates are necessary to the questions that comprise the CCI and C1CI to improve the resultant merged instrument and its psychometric properties?
3. How can calculus-specific notation be minimized in the RCCI in a manner that supports the valid use of the RCCI as a pre and post assessment instrument?

Advisory Board

- Dr. Patrick Thompson, Arizona State University
- Dr. David Bressoud, Macalester College
- Mr. Dan Teague, North Carolina School of Science and Mathematics in Durham
- Dr. April Strom, Chandler-Gilbert Community College

National Survey

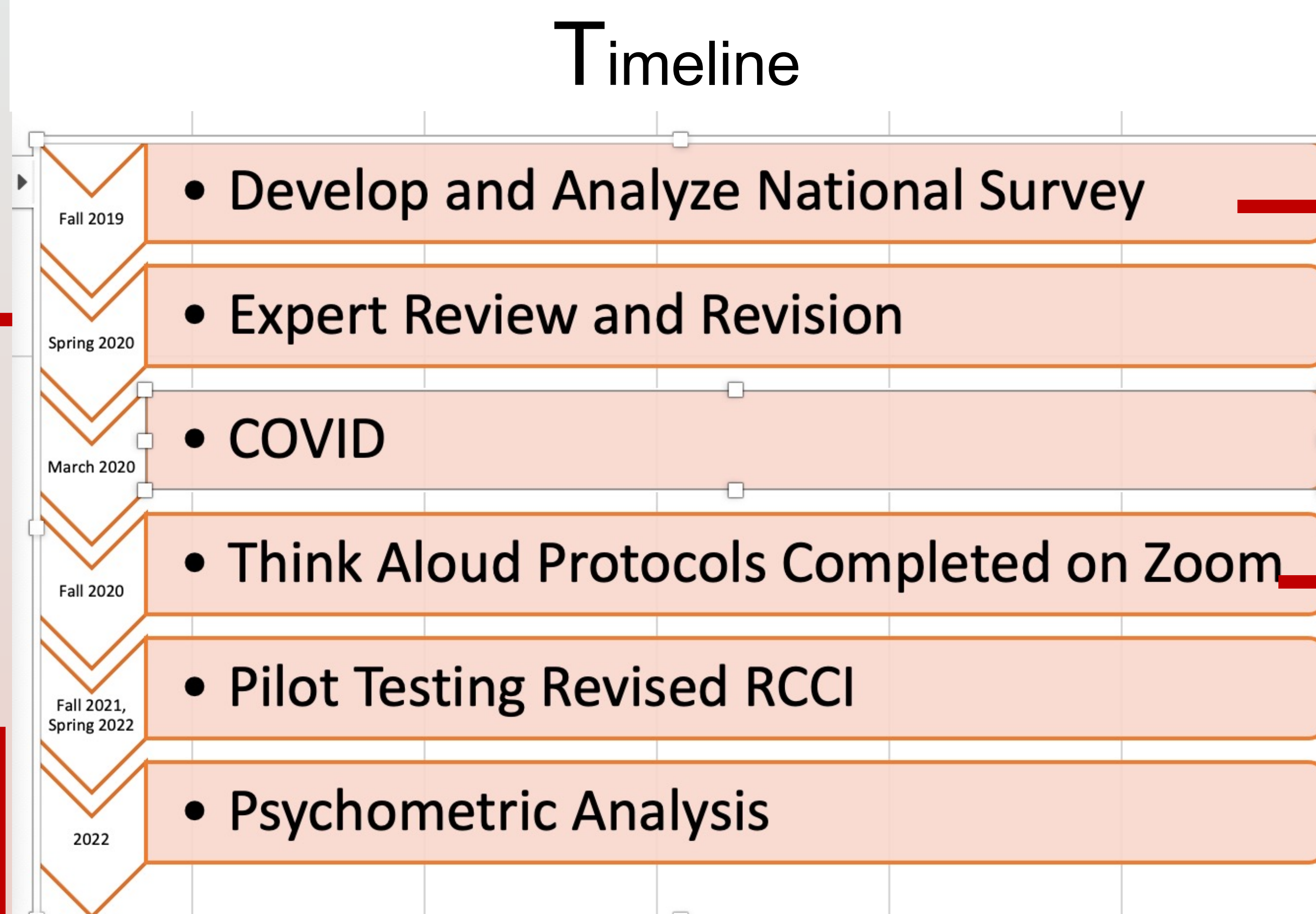
- 152 Responses
- 43% High School Teachers
- 13% Two Year Institutions
- 49% Four Year Colleges

Expert Review and Revision Panel

- Scott Adamson, Chandler-Gilbert Community College, Chandler Arizona
- David Cook, Cypress Ridge High School, Houston, Texas
- Beth Cory, Sam Houston University, Huntsville, Texas
- Rob Eby, Blinn College, Bryan Texas
- Xiao-Xiong Gan, Morgan State College, Baltimore, Maryland
- Tom Halverson, Macalester College, Saint Paul, Minnesota
- Bill Karmierczak, Binghamton University, Binghamton, Maryland
- Melinda Lanus, Auburn University, Auburn, Alabama
- Dixie Ross, Pflugerville High School, Austin, Texas
- Andre Rouhani, Desert Mountain High School, Scottsdale, Arizona

Expertise

- All First Year Calculus Instructors
- 3 High Schools
- 2 Community Colleges
- 2 Universities
- 1 Liberal Arts Colleges
- 1 Historically Black College



Zoom Think Alouds- College Ready Students

- 1 Hispanic
- 1 Native American
- 1 African American
- 1 Caucasian
- 2 Females
- 2 Males

Revised questions
for clarity.

Identified and
removed unknown
language, symbols
and terminology.

Item	Classical test theory			Item response theory				
	Easiness	Item-total r	Alpha if deleted	Difficulty	Discrimination	Guessing	Information	
Q1	0.18	0.09	0.73	3.40	0.82	0.12	0.58	
Q2	0.26	-0.02	0.74	-2.01	-22.84	0.23	12.70	
Q7	0.30	0.29	0.72	1.41	1.50	0.16	0.98	
Q8	0.47	0.26	0.72	0.92	1.08	0.24	0.60	
Q10	0.31	0.25	0.72	1.55	1.58	0.19	0.96	
Q11	0.46	0.18	0.72	0.31	0.55	0.00	0.55	
Q13	0.12	0.02	0.73	2.06	43.24	0.10	31.95	
Q15	0.17	0.18	0.72	1.96	3.36	0.13	2.33	
Q16	0.78	0.08	0.73	1.23	0.90	0.69	0.15	
Q19	0.40	0.27	0.72	1.21	1.51	0.23	0.84	
Q22	0.17	0.16	0.72	2.35	1.90	0.14	1.30	
Kuder-Richardson 21 = 0.76			Test information = 70.74					
Cronbach's alpha = 0.73								

Pilot Study Participants (so far)

- 11 Schools
- 38 Instructors
- 509 Students

- Auburn University
- Benjamin Franklin High School
- Binghamton University
- Blinn College
- Chandler Gilbert Community College
- East Madison High School
- Maricopa Community College
- Morgan State University
- Texas A&M University
- Texas Tech University
- The University of Mississippi



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