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**TRUE
GRIT**

**Why Remedial Reforms & Pathways
May Not Be the Promised Graduation
Rate Elixirs**



$$\frac{x+1}{x+2} - \frac{x+2}{x+3}$$

$$\frac{7x-5}{2x^2-3x+1} - \frac{7x+1}{1-x}$$

**The Impact of Elementary Algebra:
Does it really help our non-STEM students succeed in
college math?**

$$\frac{4}{x+3} - \frac{x+2}{x+1}$$

DEFINING ALGEBRA

NCTM, 2008

Algebra is a way of thinking and a set of concepts and skills that enable students to generalize, model, and analyze mathematical situations. Algebra provides a systemic way to investigate relationships, helping to describe, organize, and understand the world. ...Knowing algebra opens doors and expands opportunities, instilling a broad range of mathematical ideas that are useful in many professions and careers. All students should have access to algebra and support for learning it.



COURSE SEQUENCE AT NJ COLLEGES

Non - STEM Students

- Basic Math (NC)
- Elementary Algebra (NC)
- College level Liberal Arts math course (C)
 - Number Systems
 - Quantitative Reasoning
 - Contemporary Math
 - Topics in Math

STEM Students

- Basic Math (NC)
- Elementary Algebra (NC)
- Intermediate Algebra (NC)
- College Level Math
 - Precalculus /College Algebra
 - Statistics I



CONTENT OF COURSES

Elementary Algebra

- Expressions
- Equations
- Graphing
- Systems of Equations
- Polynomials
- Factoring
- Rational Expressions and Equations
- Operations on Radicals
- Quadratic Equations

Liberal Arts Math Course

- Mathematical Logic
- Basic Set Theory
- Number Systems (Ancient, Bases other than 10)
- Geometry
- Probability
- Statistics
- Modular Arithmetic
- Rational Numbers



How best could I assess the impact of Elementary Algebra?

$$\begin{aligned} (5x - 40) + (2x + 10) &= 180 \\ 7x - 30 &= 180 \\ \hline 7x &= 210 \\ \frac{7x}{7} &= \frac{210}{7} \\ x &= 30 \end{aligned}$$



STUDY INFORMATION: STUDENT POPULATION

Full-Time First-Time students needing only a Liberal Arts Math Course (non-STEM)

2012 Cohort over three years

4 NJ Community Colleges



RESULTS OF ALL NON-STEM STUDENTS

Group 1

Had to take Elementary Algebra before College Level math

- 1st Semester Math Success Rate – 28.7% (in a Elementary Algebra class)
- 3 Year Success Rate in College Level Math – 40%
- Total College Credits Earned in 3 Years – 33.22 credits

Group 2

Took no Elementary Algebra before College Level Math

- 1st Semester Math Success Rate – 69.6% (in a Liberal Arts Math Class)
- 3 Year Success Rate in College Level Math – 77%
- Total College Credits Earned in 3 Years – 49.68 credits

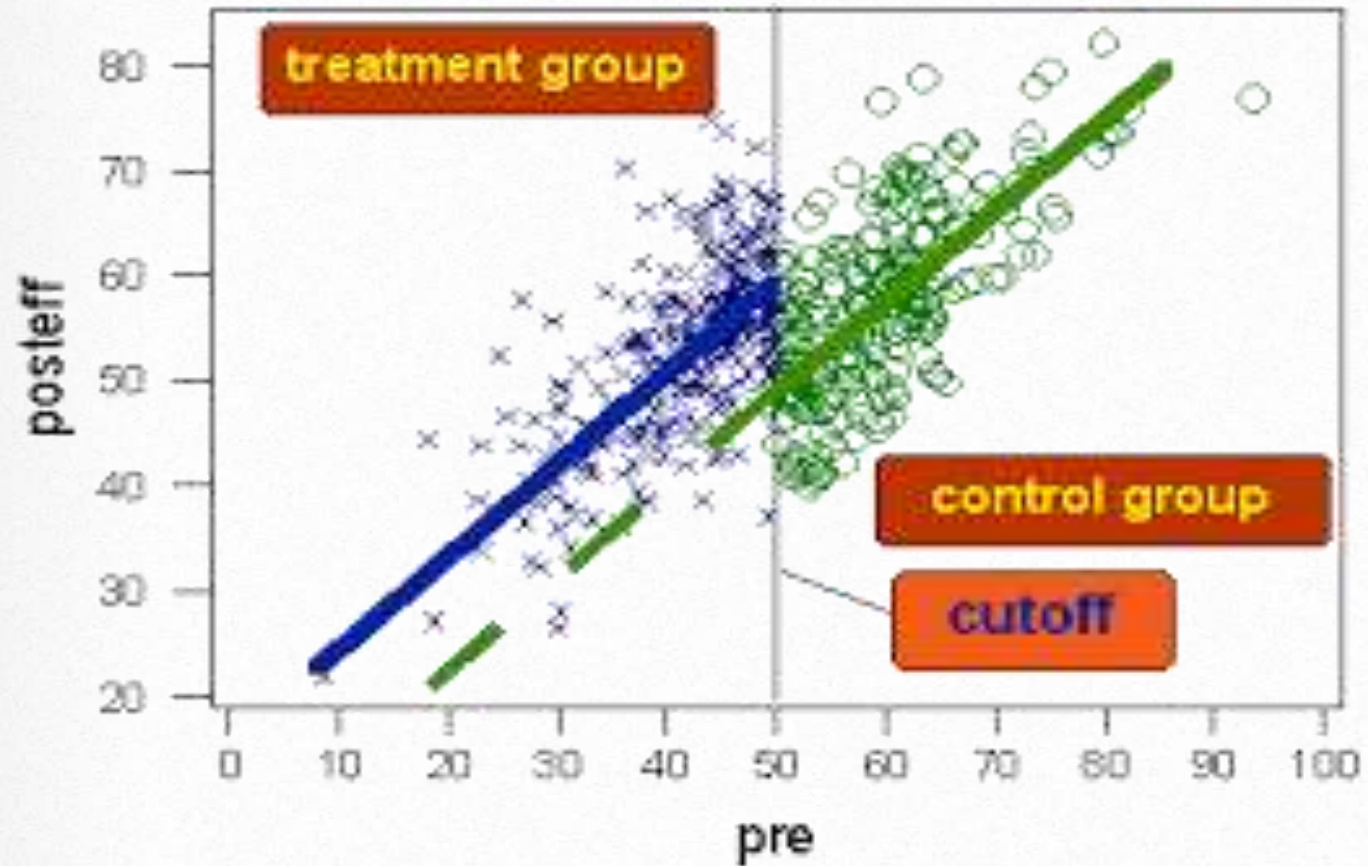


REGRESSION DISCONTINUITY DESIGN

Takes advantage of the assumption that student placement scores directly above and directly below a predetermined cutoff on a standardized placement test are essentially random within a certain window.



EXAMPLE OF RD DESIGN



RESULTS OF STUDENTS SCORING NEAR THE CUTOFF

Group 1

Had to take Elementary Algebra before College Level math

- 1st Semester Math Success Rate – 48.9%
- 3 Year Success Rate in College Level Math – 78%
- Total College Credits Earned in 3 Years – 54.3 credits

Group 2

Took no Elementary Algebra before College Level Math

- 1st Semester Math Success Rate – 70.0%
- 3 Year Success Rate in College Level Math – 74%
- Total College Credits Earned in 3 Years – 53.25 credits

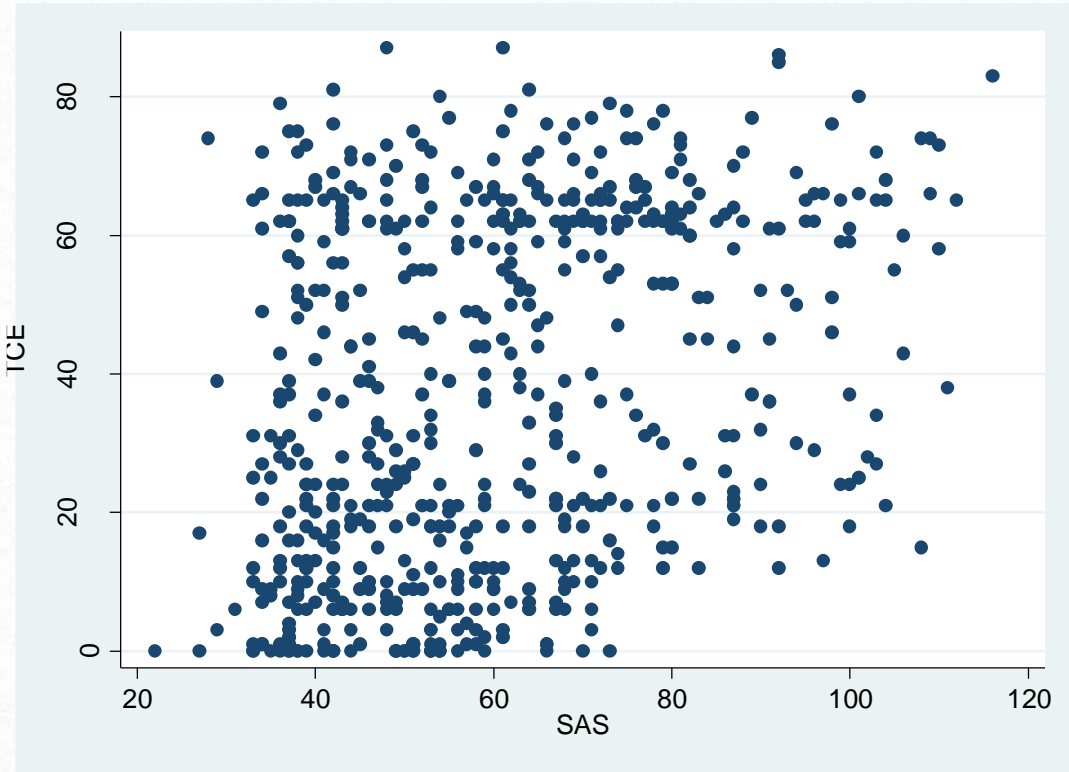
* Aggregate data for 4 NJ Community Colleges.



What does this mean?



SCATTER PLOT OF TOTAL CREDITS EARNED IN THREE YEARS BASED ON PLACEMENT SCORE



IMAGINE YOUR DATA HERE

CONCLUSIONS

A student has a better chance of passing a general liberal arts math class than they do a developmental elementary algebra course.

The placement in elementary algebra alone is NOT a barrier to student long term success in college.

We need to determine the “other” factors that are making students place low and fail to progress.



**“Do just once what others
say you can't do, and you
will never pay attention to
their limitations again.”**

James Cook



YOUR REMEDIAL SEQUENCE & OUTCOMES

**IF YOU ENROLL IN READING, WRITING &
MATH, WILL EVER GRADUATE?**

EMPOWERING COMMUNITY COLLEGES TO BUILD THE NATION'S FUTURE: AN IMPLEMENTATION GUIDE



AMERICAN
ASSOCIATION OF
COMMUNITY
COLLEGES



AACC IMPLEMENTATION GUIDE: RECOMMENDATION #1: INCREASE COMPLETION RATES 50% BY 2020

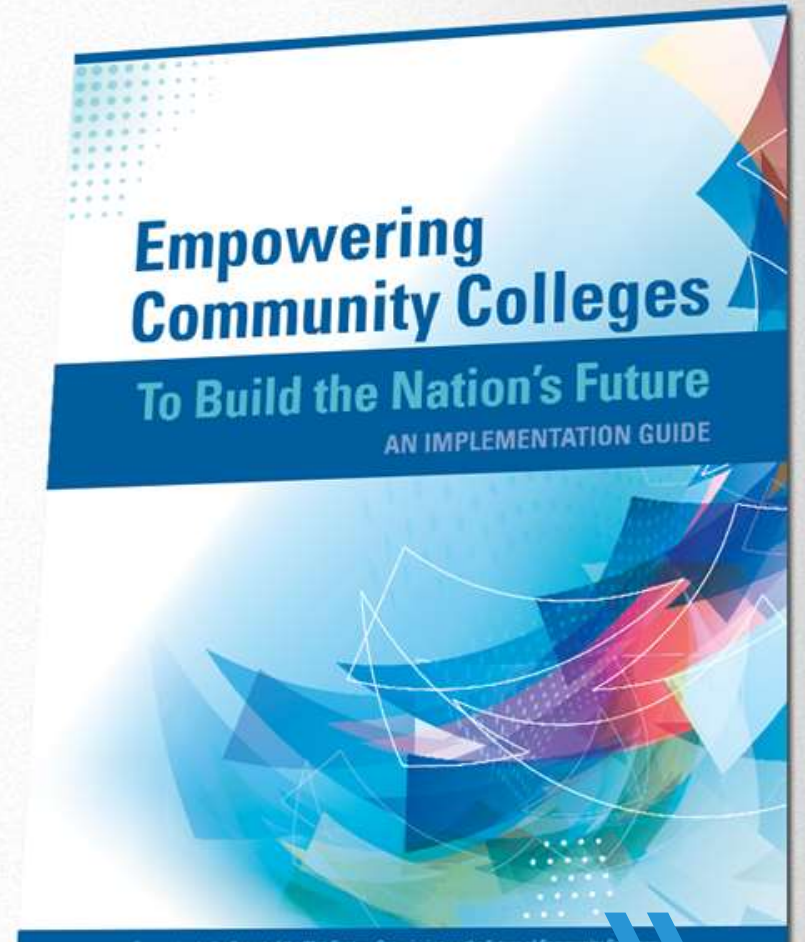
-  It will take radical action, not talk
-  Public Commitment to Goals
-  Creation of Pathways
-  Expand Prior Learning Assessments
-  Devise Completion Strategies





**Increase completion rates
by 50% by 2020**

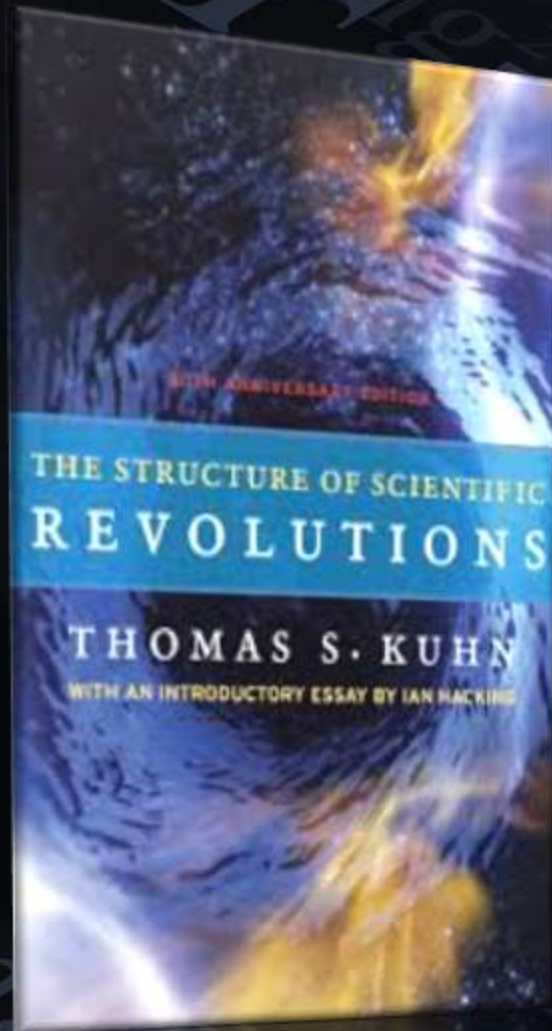
***It will take radical action,
not talk***



Although the RD Design is not a full representation of all community colleges; it does represent Warren.



PHYSICIST THOMAS KUHN



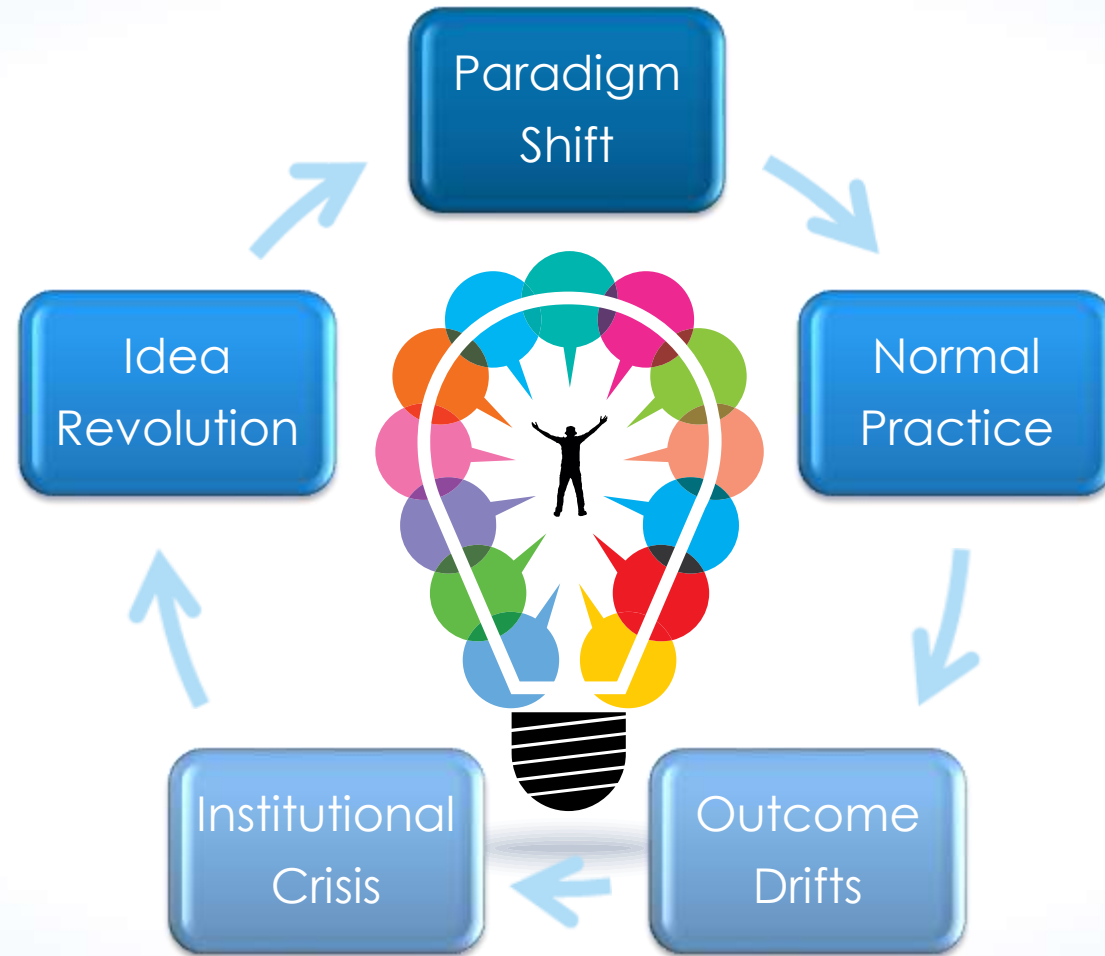
“Almost always the people who achieve these fundamental inventions of a new paradigm have been either very young or very new to the field whose paradigm they change.

And perhaps that point need not have been made explicit, for obviously these are the ones who, being little committed by prior practice to the traditional rules of normal science, are particularly likely to see that those rules no longer define a playable game and to conceive another set that can replace them.”

— Thomas S. Kuhn, *The Structure of Scientific Revolutions*



IDEA REVOLUTIONS





<https://www.youtube.com/watch?v=3cp6pEzx3uw>



To **PASS** my class all you need to do is successfully complete this problem, otherwise you are not doctoral ready as you do not possess the necessary skills for logic and reasoning required for leadership in higher education:

Multiply

$$\frac{x^2 - 4}{x^2 - 25} \bullet \frac{3x^2 - 14x - 5}{3x^2 + 6x}$$



LET'S DO RADICAL NOT TALK ABOUT IT.

- Have the data, have done the math
- Have the “Common Sense” outcomes
- Have made the national and state level conference presentations.



LET'S DO RADICAL NOT TALK ABOUT IT.

- No more committees
- Use Board Policy
- No more required remediation, buyers choice.
- Three Tracks (STEM, Non-Stem, Technical) – Faculty have Summer to do this or Board will do it for them.
- Have the science, math & research anyway.



FOR MATH

- Change the Accuplacer cut scores
- Change the sequence
- Create Aspirational Curriculum Based Tracks
- Create STEM Boot Camps
- Give consumer the choice (after you share the previous success rates)
- And just for fun – apply the math findings to English too.



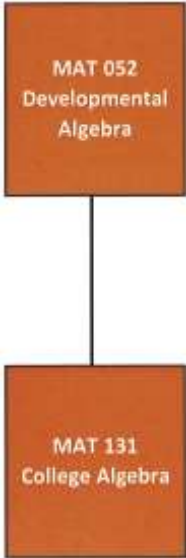
SEE EXAMPLES THAT FOLLOW

2014 MATH SEQUENCE

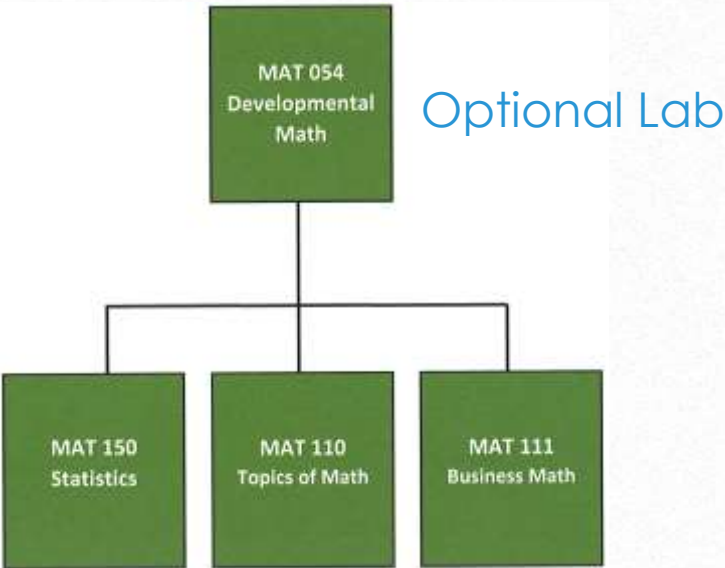


NEW MATH SEQUENCE

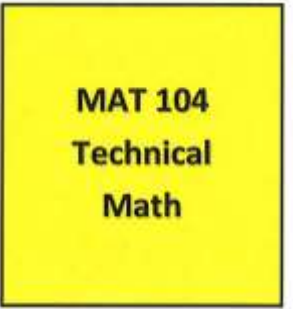
STEM



Non-STEM



Applied
(AAS)



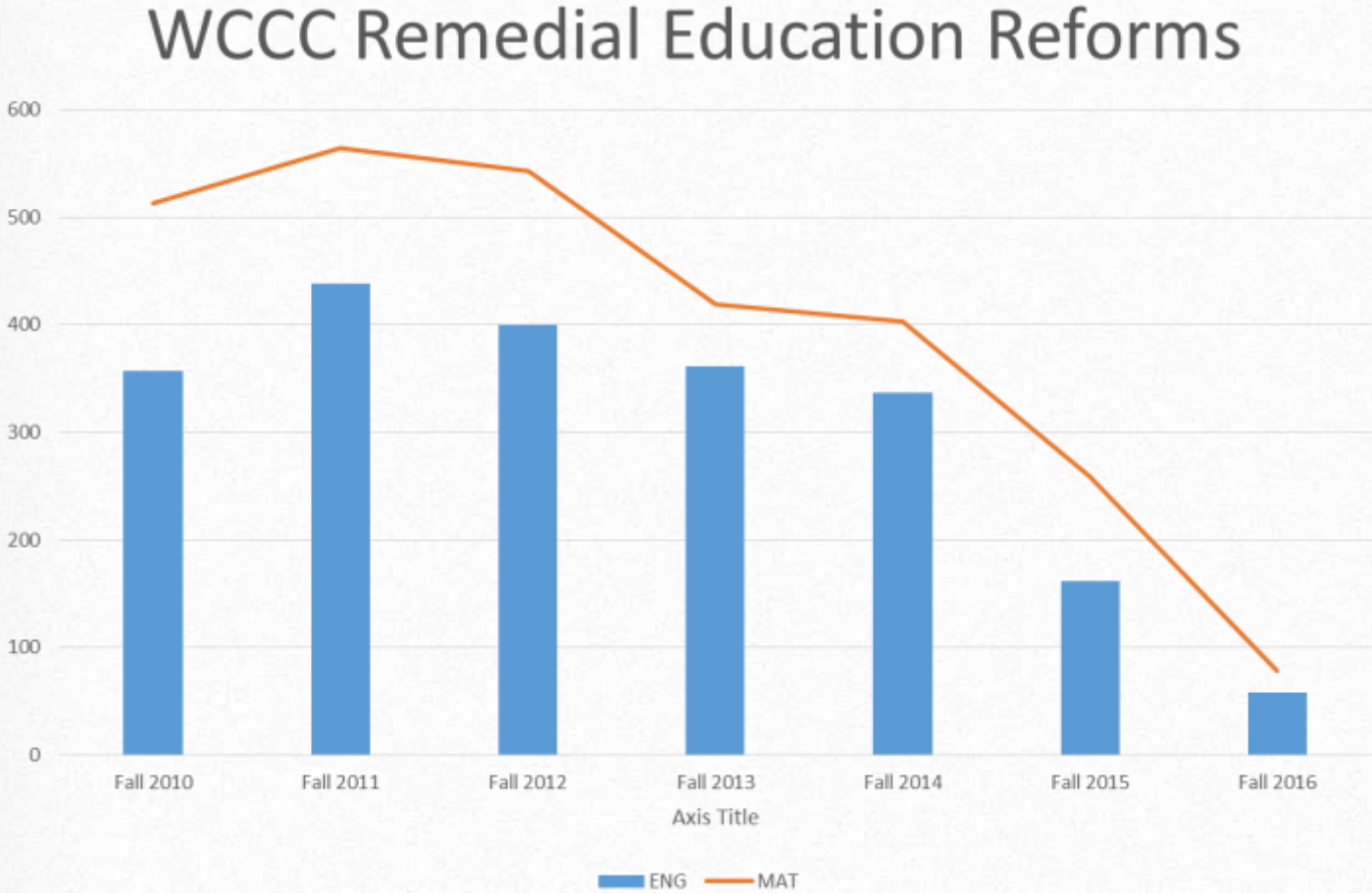
AFTER 1 YEAR

(TYPICAL COMMITTEE “GROUP THINK” OUTCOMES)

- Math Faculty Meet
- Share with each other, the stories of students who did worse than ever.
- Convince themselves via anecdotal evidence that new system is a failure
- Bring their findings (stories) with recommendations to the president via academic VP to return to old structure.
- “Hey, I know, let’s do the Math!!!!!!!”



RESULTS – REMEDIAL ENROLLMENTS



FALL 2015 (OLD SEQUENCE) & FALL 2016 (MAINSTREAM SEQUENCE)

Fall 2015

- MAT 110 Topics of Math (Non-STEM) = 74%
- MAT 111 Math for Bus (Non-STEM) = 84%
- MAT 131 College Algebra (STEM) = 70%
- MAT 131 Pass Rate of Anecdotal Expert: **50%**

Fall 2016

- MAT 110 Topics of Math (Non-STEM) = 83%
- MAT 111 Math for Bus (Non-STEM) = 82%
- MAT 131 College Algebra (STEM) = 82%
- MAT 150 (New) Elements of Statistics (Non-STEM) = 88%



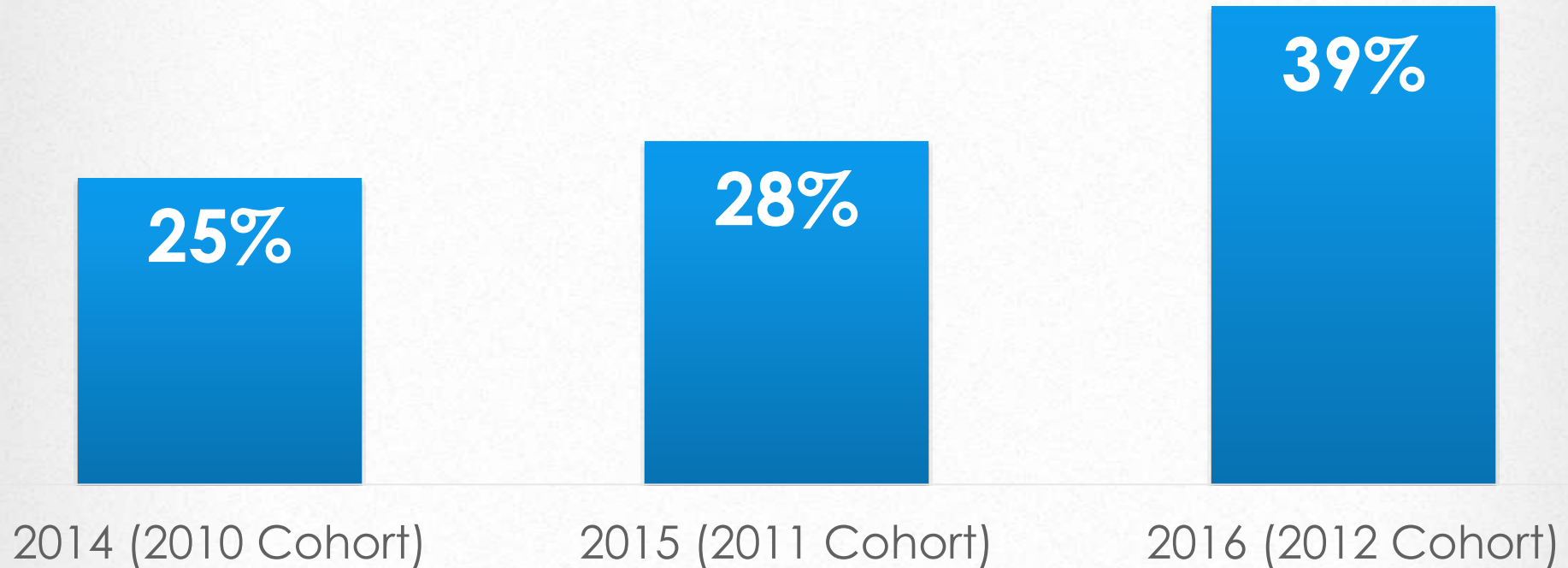
WHY?

- **Personal Economic Interests**
- **Campus Politics**
- **Power of Denial**



1/2 IMPLEMENTATION COMPLETION OUTCOMES (IPEDS)

Measured Actual Graduation Rates



LIVE GRIT, LEARN GRIT, TEACH GRIT



Vicki Davis -- <https://www.edutopia.org/blog/true-grit-measure-teach-success-vicki-davis>



PHI 101 – NOW I AM GOING TO BREAK THE RESEARCH RULES

- “Read the chapter” (they don’t read)
- Now spoon feed the chapter
- **CHANGE:** Teach Grit (1st 2 weeks)
- What happened?



OTHER RADICAL ACTIONS

Board Policy
(60 Credit
Degrees)

Teaching
Administrators

More Intrusive
Advising

Pathways Project

Professional
Development



RD REFERENCES

How to for RD Design

- Jacob, R., Zhu, P., Somers, M. & Bloom. (2012). A practical guide to regression discontinuity. MDRC. <http://www.mdrc.org/publication/practical-guide-regression-discontinuity>
- Lee, H. & Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature* 48(June 2010), 281- 355.

Examples of RD Design

- Bettinger, E. & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. In *Responding to the Challenges of Developmental Education. New Directions in Community Colleges*, no. 129. San Francisco, CA: Jossey-Bass.
- Calcagno, J. C. & Long, B. T. (2008). The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance. An NCPR Working Paper.



REFERENCES CONT.

Examples, Cont.

- Lesik, S. A. (2006). Applying the regression-discontinuity design to infer causality with non-random assignment. *The Review of Higher Education* 30(1), 1-19.
- Melguizo T., Bos, J., Ngo, F, Mills, N & Prather, G. (2016). Using a regression discontinuity design to estimate the impact of placement decisions in developmental math. *Journal of Research in Higher Education* 57, 123-1511.

Software and Technical Information

- Journal Articles and Modules for STATA and R:
<https://sites.google.com/site/rdpackage>

