

Learning to be a Successful Mathematics Teacher:

Reflections on Two Teacher Education Models

Nicholas Wasserman, Marymount School

Edward Ham, Bakersfield College

UTeach Institute Annual Conference 2011



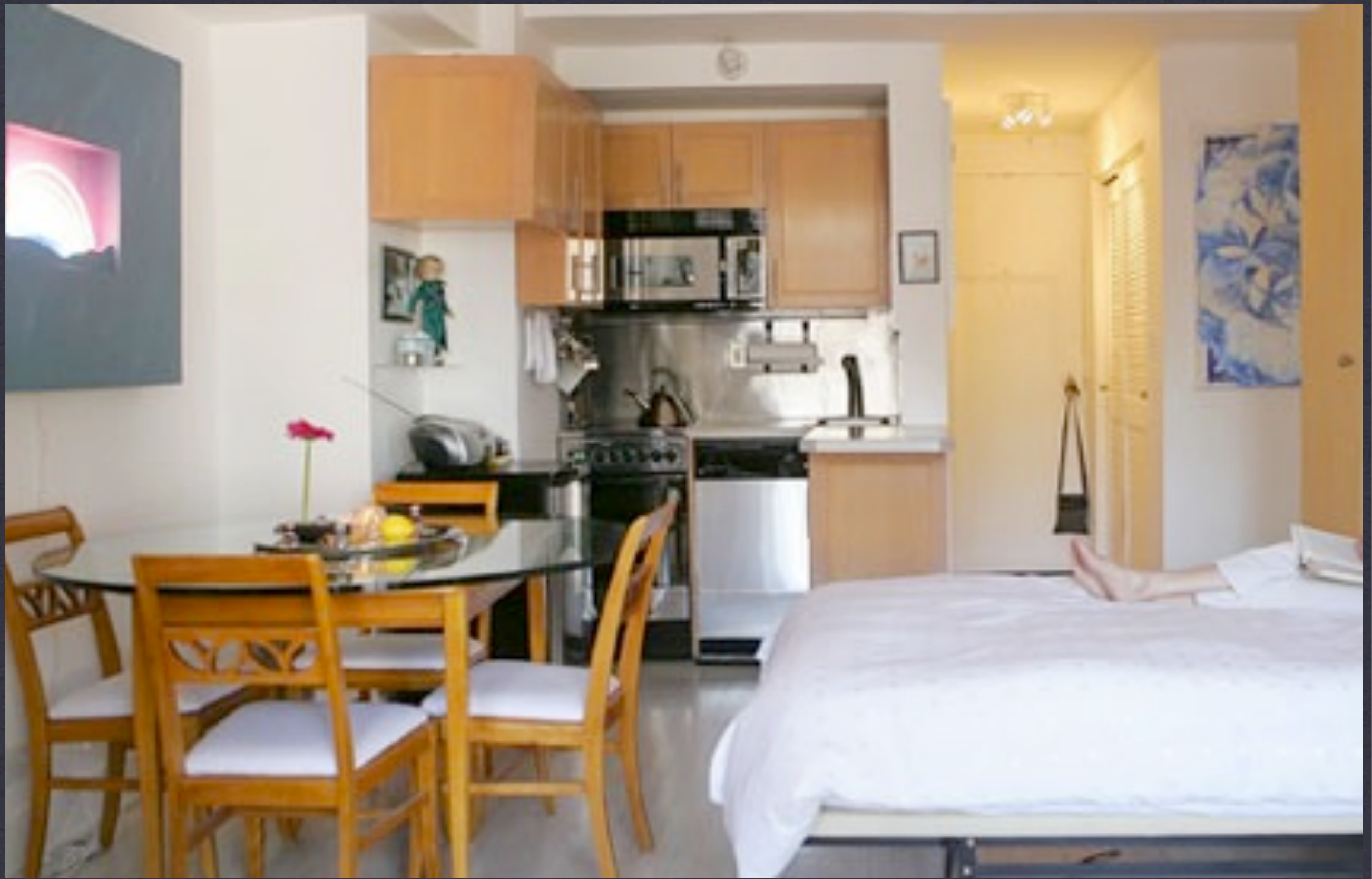
NEW YORK CITY

NEW YORK, NEW YORK



CLOSET-SIZED KITCHENS

NEW YORK, NEW YORK



500 SQUARE FOOT APARTMENTS

NEW YORK, NEW YORK



EVEN SMALLER

NEW YORK, NEW YORK



NARROW AISLES

NEW YORK, NEW YORK



CARRYING GROCERIES

NEW YORK, NEW YORK



SIDEWALK TRAFFIC

NEW YORK, NEW YORK



RAIN AND THE ELEMENTS

NEW YORK, NEW YORK



SCIENCEPHOTOLIBRARY

WIND AND THE ELEMENTS

NEW YORK, NEW YORK



LIFE

RAIN AND THE ELEMENTS

NEW YORK, NEW YORK



LIFE

THE IMPORTANCE OF A GOOD UMBRELLA

NEW YORK, NEW YORK



WAITING

NEW YORK, NEW YORK



UMBRELLA GRAVEYARD

NEW YORK, NEW YORK



CROWDED SUBWAYS

NEW YORK, NEW YORK



SUMMER HEAT

NEW YORK, NEW YORK

Transitioning to NYC Living:

- **WHAT TYPES OF PEOPLE THRIVE IN A CITY LIKE THIS?**
- **HOW MIGHT YOU PREPARE TO LIVE IN A CITY LIKE THIS?**
- **BECOMING A NEW YORKER...**

The Transition to Teaching

BEGINNING SECONDARY MATHEMATICS TEACHERS

WHAT?

DOES GOOD TEACHING LOOK LIKE?
DO GOOD TEACHERS DO THAT
HELP THEM SUCCEED?

HOW?

IS GOOD TEACHING DEVELOPED?
CAN IT BE IMPLEMENTED?

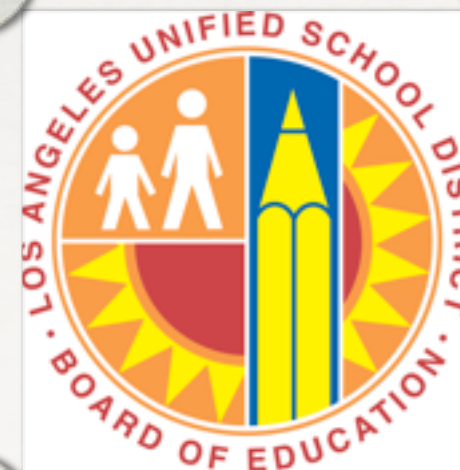
WHEN?

ARE ATTRIBUTES OF GOOD TEACHING
DEVELOPED, LEARNED OR
EXPERIENCED?

Research Questions

1. How do beginning mathematics teachers define “success” in regard to their first year teaching?
2. To what factors or experiences would beginning mathematics teachers attribute the success of their first year teaching?
3. To what degree were these significant attributes or experiences learned pre-teacher education program, during program, or post-program?

Participants



Beginning teachers, mathematics graduates from:
December 2007, May 2008, December 2008, or May 2009

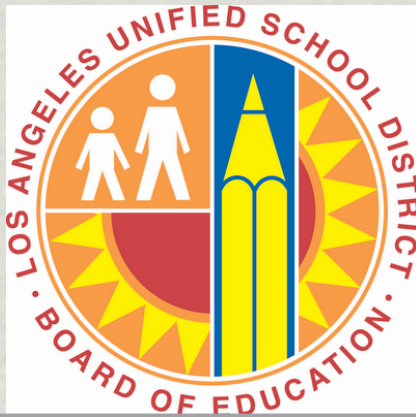
**37 out of the possible 49 UTeach graduates participated
75% response rate**

**28 out of the possible 35 LAUSD graduates participated
80% response rate**

Populations

Population

California Alternative



Texas Traditional





Populations

Population	Length of Program
<p>California Alternative</p>  <p>The logo is circular with a red border. Inside, there are two stylized human figures (one larger, one smaller) in white and blue, a yellow pencil, and a sunburst pattern. The text 'LOS ANGELES UNIFIED SCHOOL DISTRICT' is at the top and 'BOARD OF EDUCATION' is at the bottom.</p>	<p>4 weeks plus during 1st year</p>
<p>Texas Traditional</p>  <p>The logo features the text 'UTeach' in a large, bold, sans-serif font. Below it, in smaller text, is 'THE UNIVERSITY OF TEXAS AT AUSTIN' and 'NATURAL SCIENCES'. To the right of the text is a red apple with a green leaf and a yellow outline of the state of Texas on its side.</p>	<p>4 years</p>


Populations

Population	Length of Program	Program Field experience
California Alternative 	4 weeks plus during 1 st year	~10 days
Texas Traditional 	4 years	~115 days (Student Teaching, and 4 other field requirements)



Populations

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<p>California Alternative</p> 	<p>4 weeks plus during 1st year</p>	<p>~10 days</p>	<p>Graduates and Career changers</p>
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<p>California Alternative</p> 	<p>4 weeks plus during 1st year</p>	<p>~10 days</p>	<p>Graduates and Career changers</p>	<p>No</p>
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Populations

Population	Length of Program	Program Field experience	Typical Age	Math Major required	Working environment
<p>California Alternative</p> 	4 weeks plus during 1 st year	~10 days	Graduates and Career changers	No	Title 1 Schools
<p>Texas Traditional</p> 	4 years	~115 days (Student Teaching, and 4 other field requirements)	Recent Graduates	Yes	Various

3 Profiles of Teachers

1

- **Teacher was genuinely passionate about education**
- **Large improvement in students' test scores**
- **The class was disorganized at times**
- **Students did not especially like or dislike the teacher**
- **Lessons were dry, but mostly informative**
- **Colleagues did not mention departmental involvement**

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2

- **Administrators had good evaluations of the teacher**
- **Slight improvement in students' test scores**
- **Did not show much enthusiasm while teaching**
- **Highly collaborative with other colleagues**
- **Differentiated instruction for different types of learners**
- **Class had minimal student involvement; very orderly**

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- **No notable improvement in students' test scores**
- **The class ran smoothly, very few disruptions**
- **Students liked the teacher**
- **Teacher showed signs of growing professionally**
- **Did not work well with other teachers; teachers feedback was mediocre**

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1. Defining Success

1=Most Important; 2=Important; 3=Least Important

U Teach Beginning Teachers (n = 37)

LAUSD Beginning Teachers (n=28)

Q	Attribute	Mean	StdDev	Mean	StdDev
1g	GOOD CLASSROOM LEARNING ENVIRONMENT – including discipline, management, participation, etc.	1.27	0.51	1.11	0.31
1b	Creating and implementing ENGAGING LESSONS for all students	1.43	0.65	1.50	0.64
1h	A belief in yourself as a teacher to GROW PROFESSIONALLY	1.68	0.71	1.57	0.63
1d	Having GOOD RAPPORT with students	1.68	0.72	1.61	0.63
1c	Participating in productive COLLABORATION with colleagues	1.76	0.58	2.46	0.69
1a	Using DIFFERENTIATION to cater to all student learning needs	1.86	0.54	2.21	0.74
1e	POSITIVE FEEDBACK on your teaching from colleagues, administrators, students, etc.	1.97	0.50	2.04	0.74
1f	GOOD STUDENT TEST SCORES relative to the school average	2.38	0.55	2.00	0.90

Defining Success

Without a good classroom environment, students “won’t feel comfortable to learn,” and teachers won’t be able to “show their enthusiasm...” [various]

“my hands on learner...needs to touch a conics section to understand...and trying to incorporate all those learning styles at least somewhere in your unit...I think you’re reaching all your learners then.” It is the process of engaging students, that while not absolutely necessary for learning, “maximize[s] their learning.” [Abby]

...there’s such a fine line between controlled chaos and complete chaos...So I’m big on the cooperative learning, but its got to be done in such a fashion... maintaining that classroom management I think allows that type of learning; without it, I don’t think cooperative learning can really take place. [Abby]

I also think that engaging lessons and a good classroom learning environment kind of go hand in hand. Each allows the other to happen; if my lessons are engaging, I don’t have to worry about classroom management. Also, if my classroom management behaves well, I’m more willing to take the risks and make really interactive and engaging lessons because I don’t have to worry about keeping my students on track. [Gerry]

Defining Success

You want to come back... ending this first year and I'm happy... Looking back and being like... I succeeded enough.. I did what I could and I'm okay with that...[but] I can do so much better next year... So that desire makes me want to come back. [Elisa]

That whole first year is like, whoa. So that I think is important to come away with...This is what I want to do. I think that your desire to be a teacher...is big in making you a success. [Abby]

Well the biggest thing is making it through it and still wanting to do it. I feel like a lot of people give up after that first year...Because immediately after my first year I was thinking of everything that I could change to make the next year even better. And even though I did have some rough times, it was a good year. I was really happy with it. I felt like I did everything I could. [Erin]

Perhaps...they hate math, but at least they like me, so some of me rubs off on math... [Elisa] And if students feel like they can trust you, then there's purpose to their learning. [Rebecca]

Implications

The framework for how beginning teachers defined success in this study revolves around feeling comfortable – in the classroom, with students, and with being a teacher.

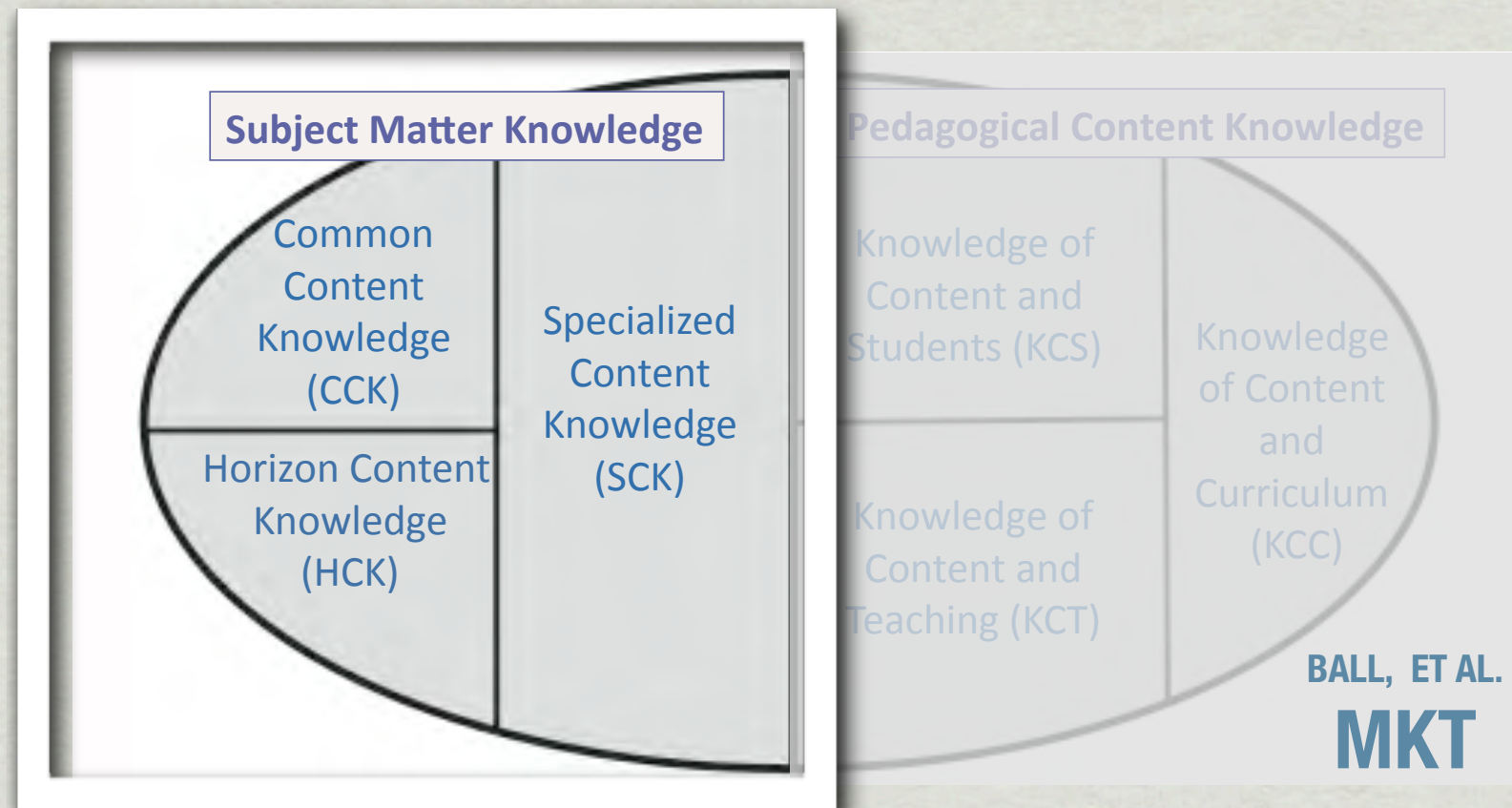
Counter to the growing national trend of using value-added measures of student test scores as a component of teacher evaluations and pay, the beginning mathematics teachers of this study did not value good student test scores as necessarily indicative of successful teaching.

2. Learning Attributes of Success

First, we'll begin by looking at what some of the literature identifies as important attributes that contribute to good mathematics teaching.

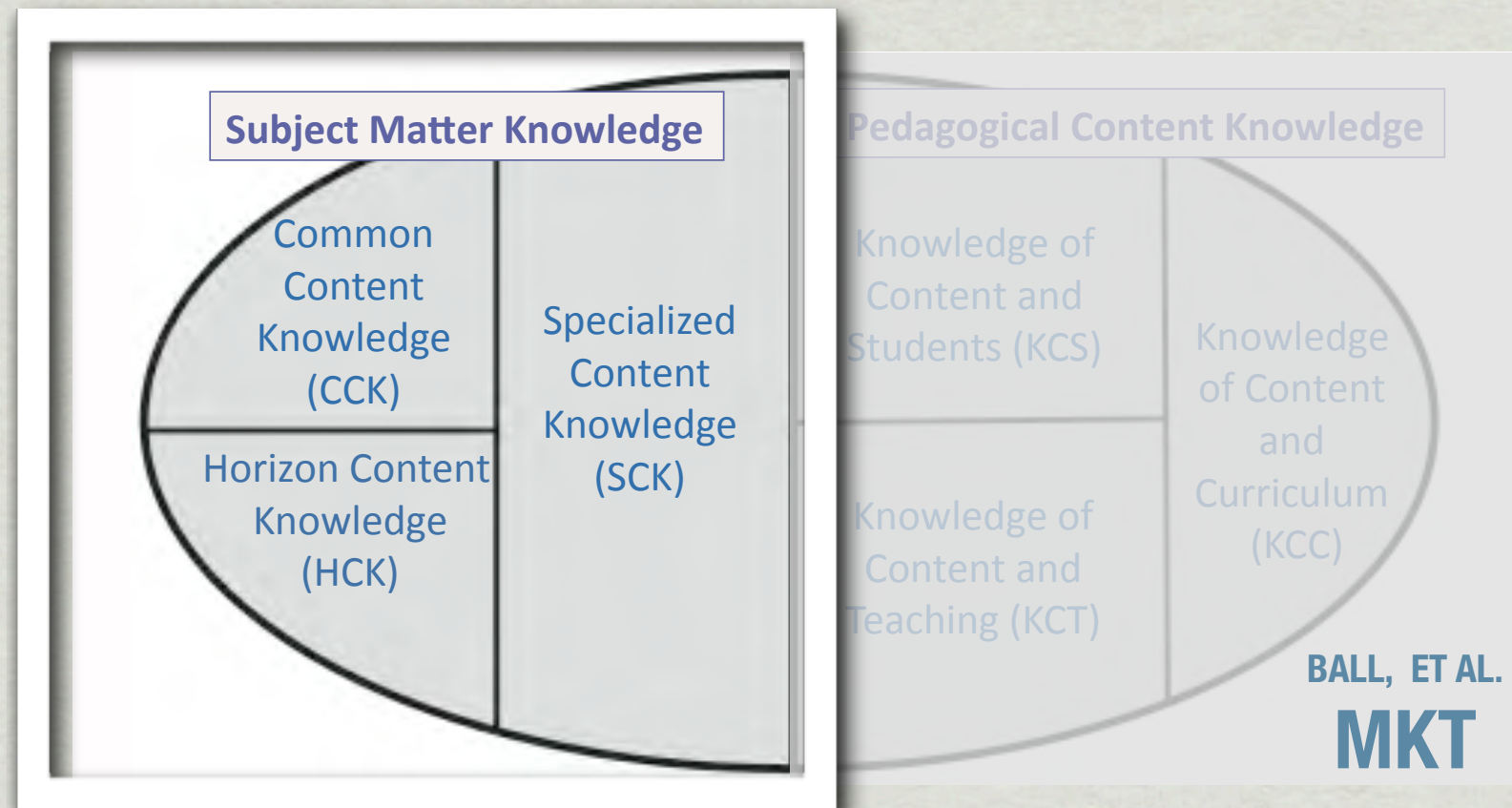
1. Mathematics Knowledge
2. Pedagogical Content Knowledge
3. Personal Traits

Mathematics Knowledge



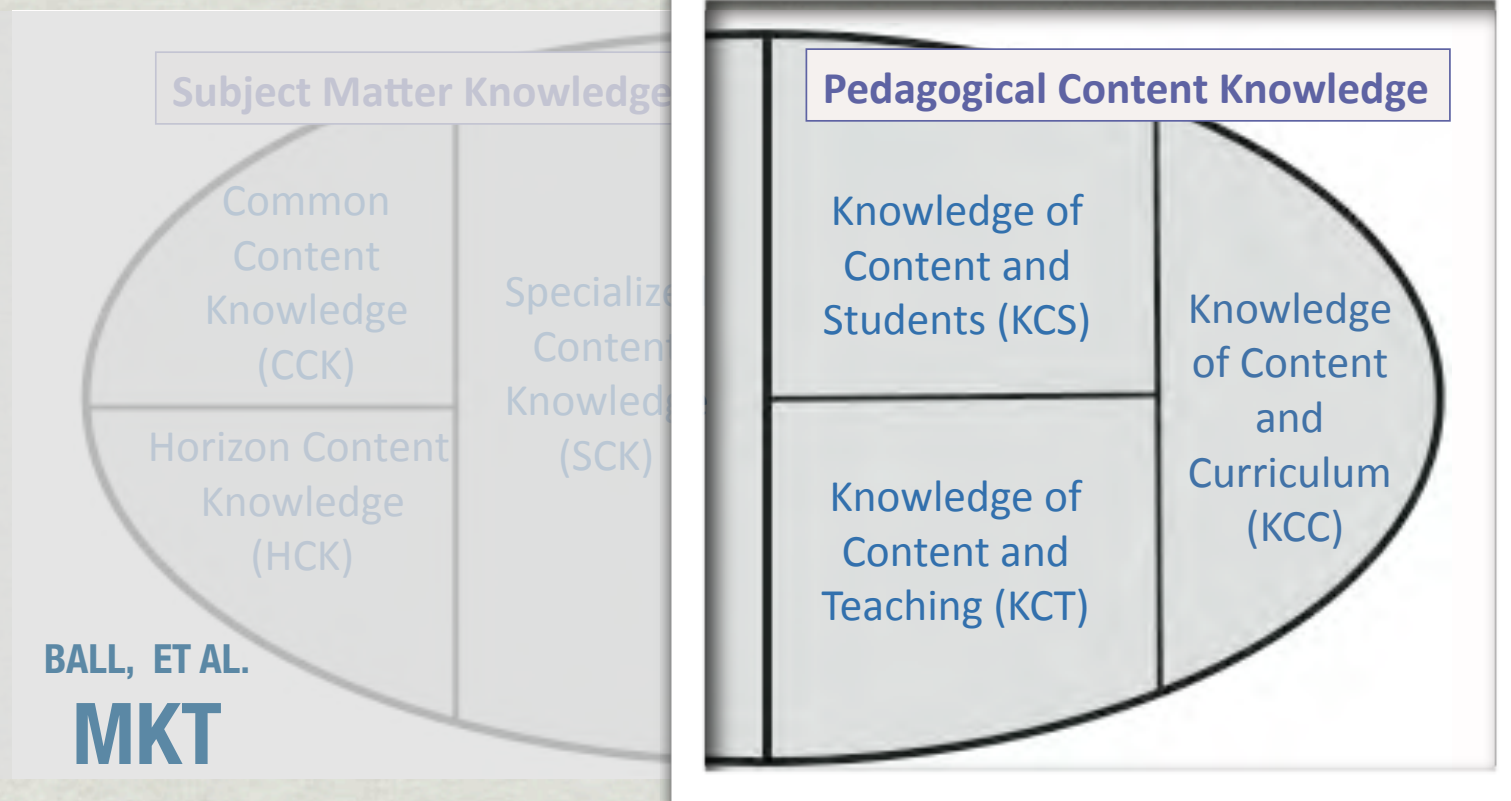
**...NOT JUST THE FORMAL QUALIFICATIONS IN MATHEMATICS, BUT THE NATURE OF THE SUBJECT KNOWLEDGE THAT HAS BEEN ACQUIRED...
(CARROLL, 2005; BROWN & BORKO, 1992; SHULMAN, 1986)**

Mathematics Knowledge



Yet while a strong content knowledge is useful for teaching, Davis and Brown (2009) note that it is easy to find deviations from this rule – strong teachers who lack formal content instruction, or those strong in content who are ineffective teachers.

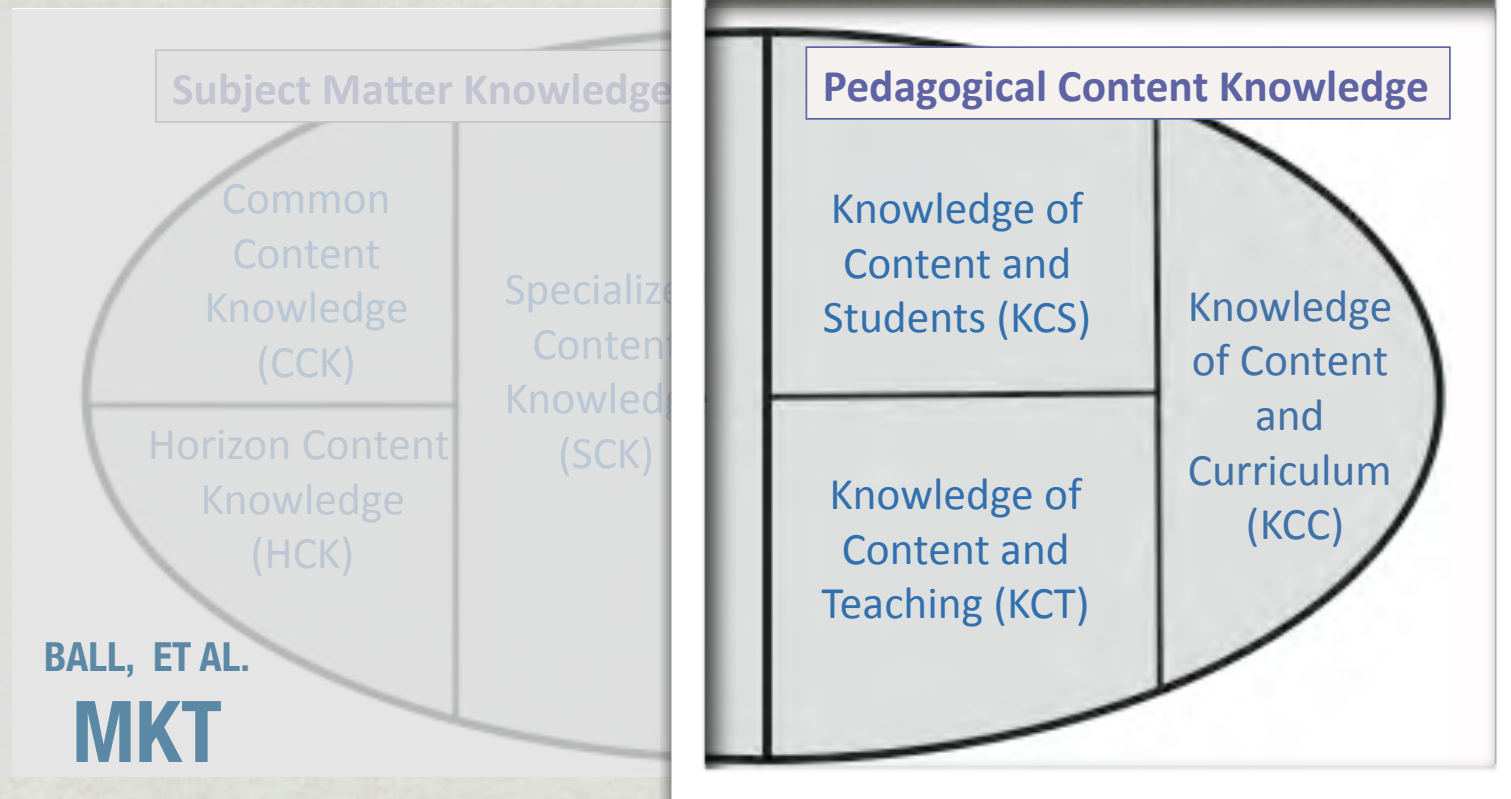
PCK



...THE MOST USEFUL FORMS OF REPRESENTATION, THE MOST POWERFUL ANALOGIES, ILLUSTRATIONS, EXAMPLES, AND DEMONSTRATIONS - IN A WORD, THE WAYS OF REPRESENTING AND FORMULATING THE SUBJECT THAT MAKE IT COMPREHENSIBLE TO OTHERS...

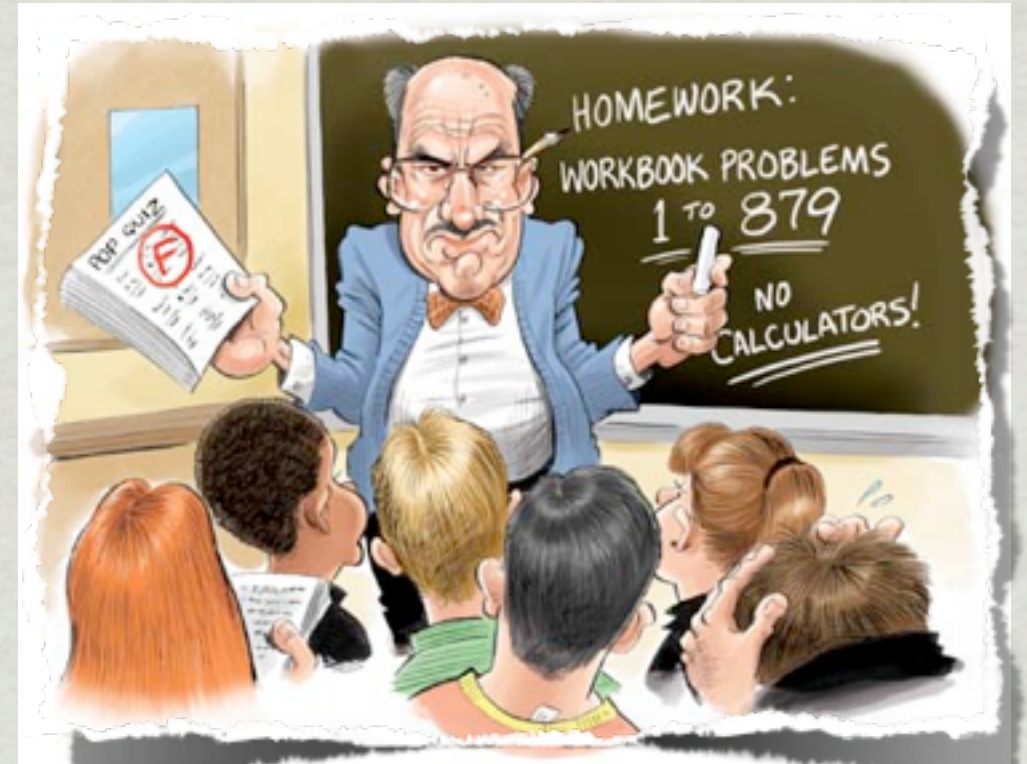
(SHULMAN, 1986)

PCK

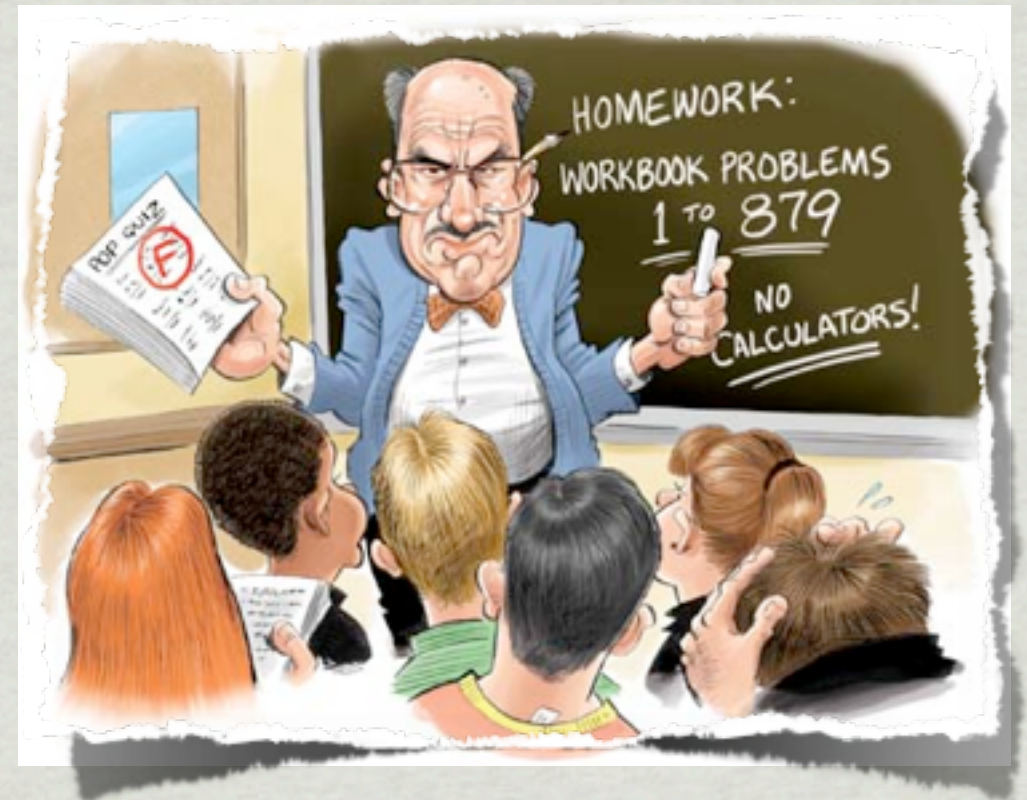


Neubrand and Seago (2009) note the relationship between Mathematical and Pedagogical Knowledge...people who possess strong content knowledge are also highly likely to possess strong pedagogical content knowledge...but these two types of knowledge do exist independently of one another

Personal Traits



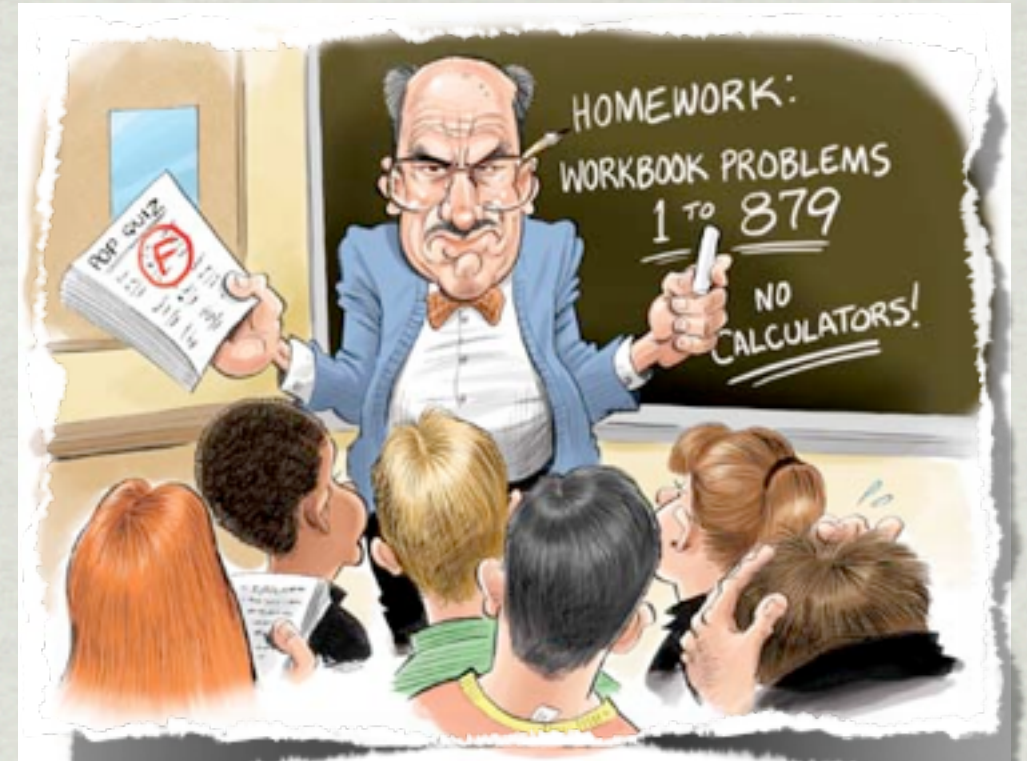
Personal Traits



Personal Traits

Personable

flexible, enthusiastic, clear, well organized, caring, humorous, confident, approachable and respectful



Considerate of the Student
adapt to individual differences, provide specific feedback, promote active learning, motivate students, encourage questions, and be good at gauging student comprehension levels

Research instruments

QUANTITATIVE SURVEY...

WAS DEVELOPED INCORPORATING IDEAS OF SUCCESSFUL MATHEMATICS TEACHING FROM NCTM AND OTHER RELEVANT LITERATURE.

(can be seen at: <http://eh2351.limequery.com/>)

QUALITATIVE SEMI-STRUCTURED INTERVIEW...

WAS DESIGNED TO EXPAND UPON RESPONSES FROM THE SURVEY, AND IN PARTICULAR TO GIVE MORE DEPTH TO THE CONCLUSIONS OF WHEN?.

Large, Broad

Select, Deep

Methodology

Develop Survey

Strand	Item #	Variable
Knowledge for Mathematical Tasks	2	Engaging Mathematical Activities
	11	Confident in Mathematics
	12	Depth and Breadth of Mathematics
	13	Problem Solver
	14	Knowledge of State Standards
Role in Discourse	30	Mathematics Knowledge
	7	Teacher-Centered Instruction
	8	Active Student Participation
	9	Heuristic Hints/Questioning Strategies
Learning Environment	21	Flexible/Adaptable
	29	Model of Mathematics Teaching
	1b	Engaging Lessons
	1a	Good Rapport
	1g	Good Classroom Learning Environment
Tools to Enhance Discourse	15	Classroom Management
	17	Belief in All Students
	3	Technology
	6	Differentiation
Analysis of Teaching and Learning	9	Heuristic Hints/Questioning Strategies
	10	Contextualize
	24	Resources
	1a	Assessments for Differentiation
	1e	Positive Feedback
	1f	Good Student Test Scores
Personality	5	Reflect
	21	Flexible/Adaptable
	22	Assess Lesson Objectives
Beliefs	19	Organized
	20	Enthusiasm
Colleagues	23	Previous Experience
	1h	Growing Professionally
Current Job	16	Efficacy
	18	Grow Professionally
U Teach preparation	1c	Collaboration with Colleagues
	4	Collaborate
	24	Resources
U Teach preparation	25	Job Satisfaction
	26	U Teach
	27	Pre-U Teach
	28	Post-U Teach
	31	Achieving Success

Methodology

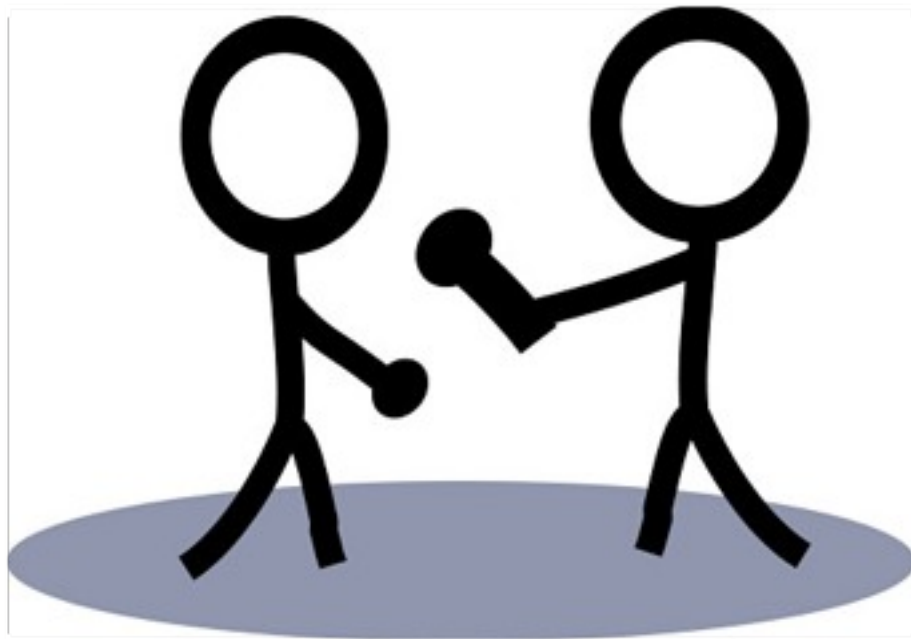
Develop Survey



15 identified in Select group also interviewed

SELECTION CRITERIA:

1. Nominations from knowledgeable teacher educators as the top of his/her graduating class
2. A minimum 3.0 GPA in college Mathematics courses
3. And to have held some sort of leadership position prior to teaching



Methodology

Sample - Teachers were selected from respective teacher certification programs

Participating
Mathematics
Teachers

Subsamples - A select group of teachers were chosen to participate in the qualitative portion of the study

Interviewed

Others

Research Instruments

Quantitative
Survey

Qualitative
Semi-
Structured
Interview

Quantitative
Suvey

Mixed- Methods
Research Design

2. Common Attributes

WHAT ARE THE ATTRIBUTES YOU THINK MIGHT BE MOST HELPFUL TO BEGINNING TEACHERS?

NOT NECESSARILY WHAT “DEFINES” SUCCESS (I.E. NOT THE BENCHMARKS FOR DETERMINING GOOD OR BAD), BUT THE THINGS THAT HELP BEGINNING TEACHERS ACHIEVE IT.

2. Common Attributes

Texas - Traditional

Interview (n=8)

Mathematics Knowledge

Caring/Belief in all students

Inquiry Engaging Pedagogy

Experimenting and Practical Tools

Hard-working

Contextualize/Flexible

Classroom Management

Colleagues, Collaboration

Other Personality Traits

Previous Experiences

2. Common Attributes

Texas - Traditional

Interview (n=8)	Survey (n=37)
Mathematics Knowledge	Mathematics Knowledge (11, 13, 14)
Caring/Belief in all students	
Inquiry Engaging Pedagogy	Engaging Mathematical Activities (2), Active Student Participation (7)
Experimenting and Practical Tools	Technology (3), Heuristic Hints/ Questioning Strategies (9)
Hard-working	Growing Professionally (18), Confidence/Efficacy (16, 5)
Contextualize/Flexible	Flexible or Adaptive to Context (10, 21)
Classroom Management	Classroom Management (15)
Colleagues, Collaboration	Collaboration (4)
Other Personality Traits	Organized (19), Enthusiastic (20)
Previous Experiences	Previous Experience (23)

2. Common Attributes

Texas - Traditional

California - Alternative

Interview (n=8)	Survey (n=37)	Interview (n=7)
Mathematics Knowledge	Mathematics Knowledge (11, 13, 14)	Mathematics Knowledge
Caring/Belief in all students		Caring/Belief in all students
Inquiry Engaging Pedagogy	Engaging Mathematical Activities (2), Active Student Participation (7)	Making mathematics content accessible to all students
Experimenting and Practical Tools	Technology (3), Heuristic Hints/ Questioning Strategies (9)	Use of technology in the classroom
Hard-working	Growing Professionally (18), Confidence/Efficacy (16, 5)	Hard-working, Sacrifice
Contextualize/Flexible	Flexible or Adaptive to Context (10, 21)	
Classroom Management	Classroom Management (15)	Classroom Management
Colleagues, Collaboration	Collaboration (4)	Colleague Support, Methods and Advice
Other Personality Traits	Organized (19), Enthusiastic (20)	Personality
Previous Experiences	Previous Experience (23)	Prev. leadership experience

2. Common Attributes

Texas - Traditional

California - Alternative

Texas - Traditional		California - Alternative	
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Hard-working	Growing Professionally (18), Confidence/Efficacy (16, 5)	Hard-working, Sacrifice	Grow Professionally (18), Efficacy (16), Reflection (5)
Contextualize/Flexible	Flexible or Adaptive to Context (10, 21)		Adaptive to Context (10)
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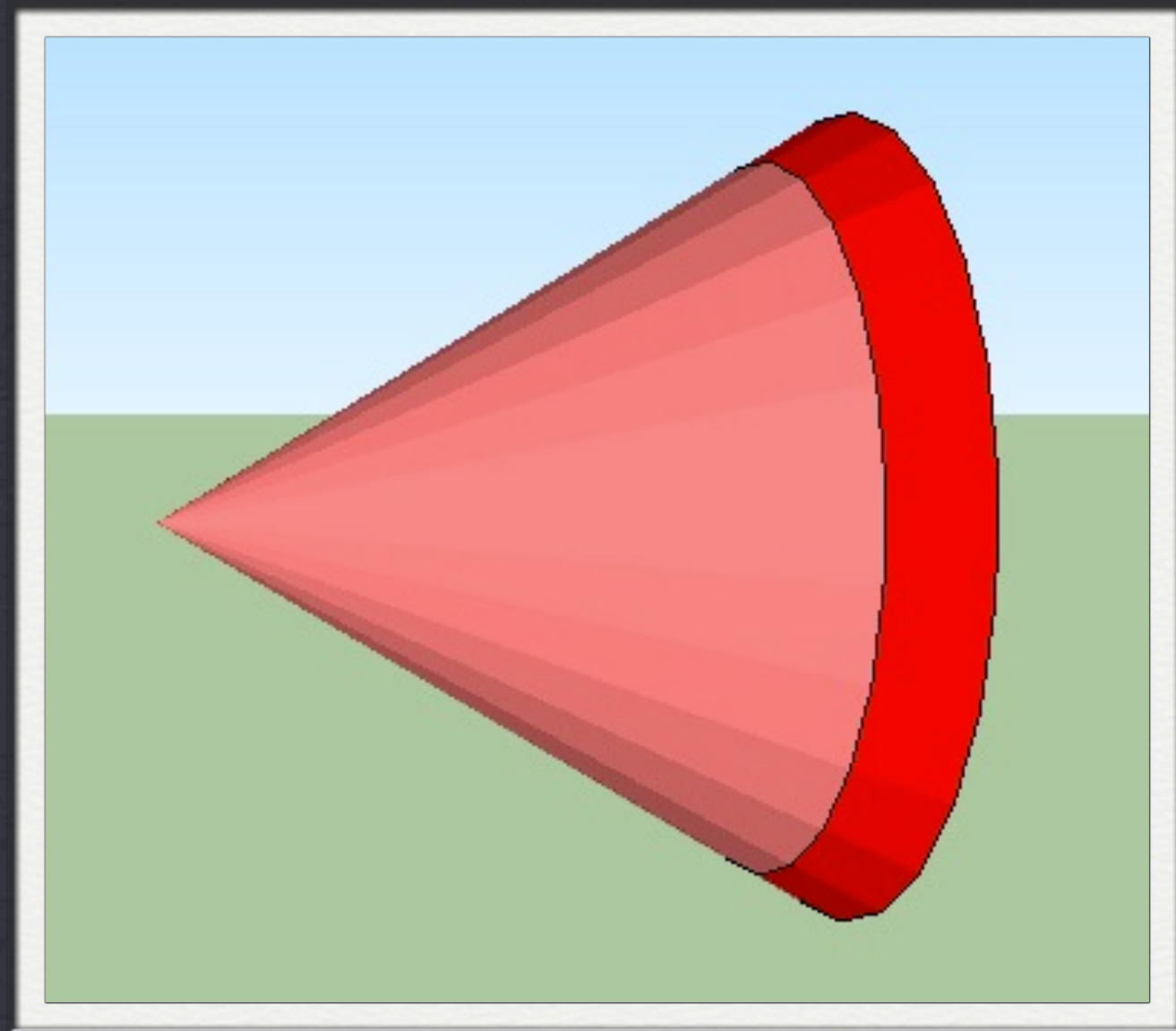
**How impressed are you by
someone who uses a
formula sheet to find the
Volume of a Sphere?**

**How impressed are you by
someone who uses limits,
and the ideas of Calculus
to justify the Volume of a
Sphere?**

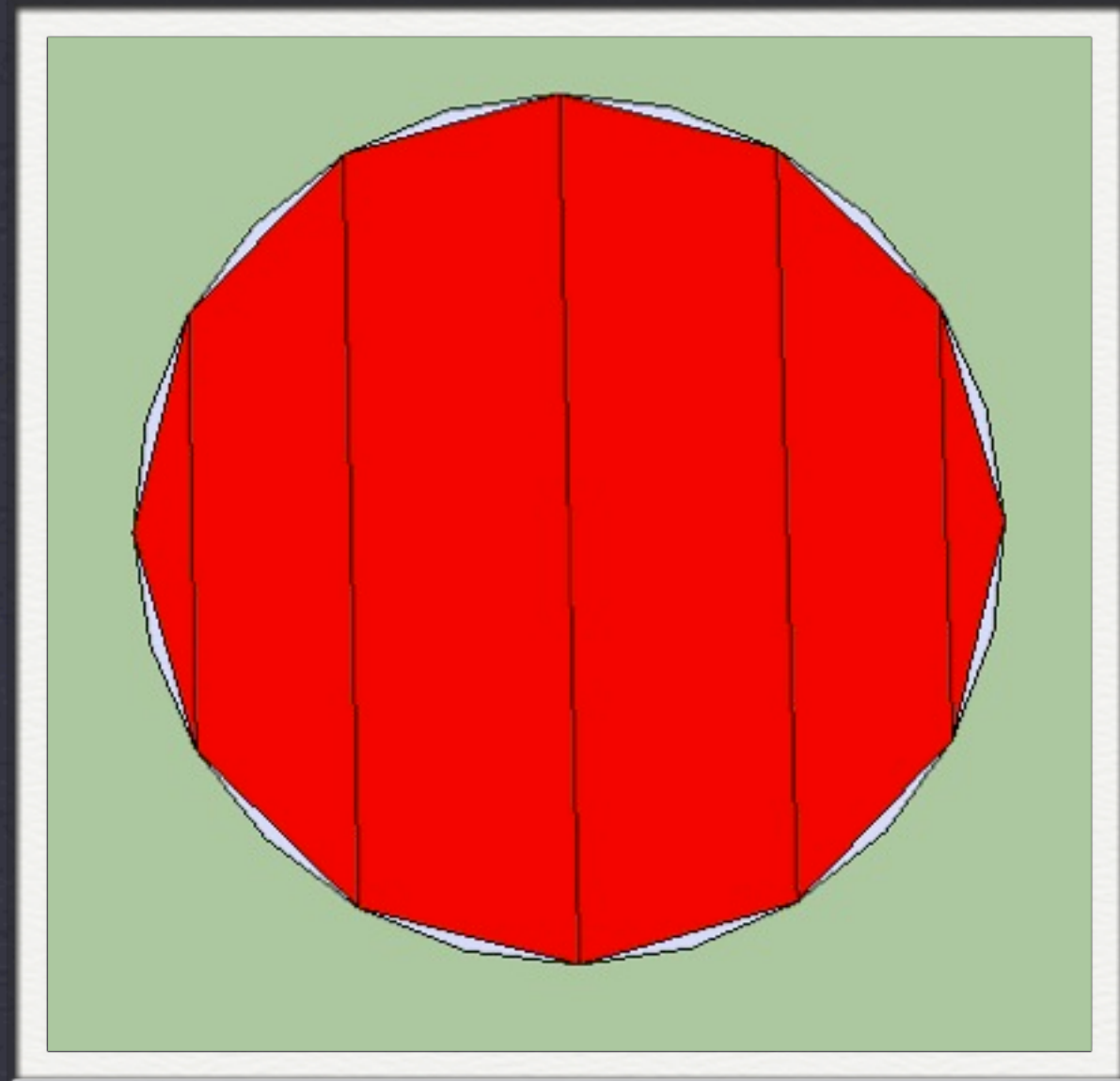
How impressed are you by
someone who, **living in**
1750, uses limits, and the
ideas of Calculus to justify
the Volume of a Sphere?

How impressed are you by someone who, **living in 250 BC**, uses limits, and the ideas of Calculus to find the Volume of a Sphere?

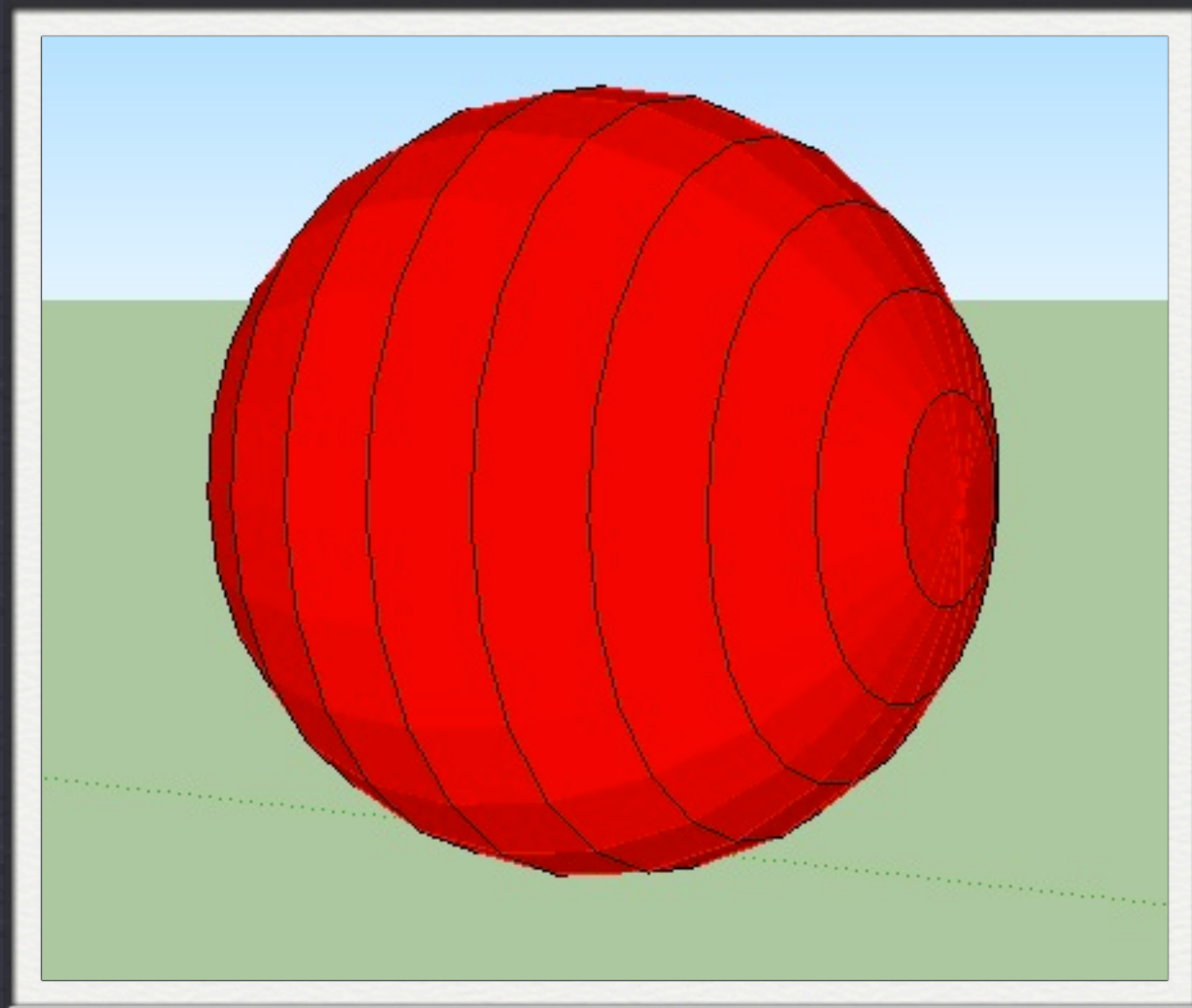
**This is precisely what
Archimedes did...**



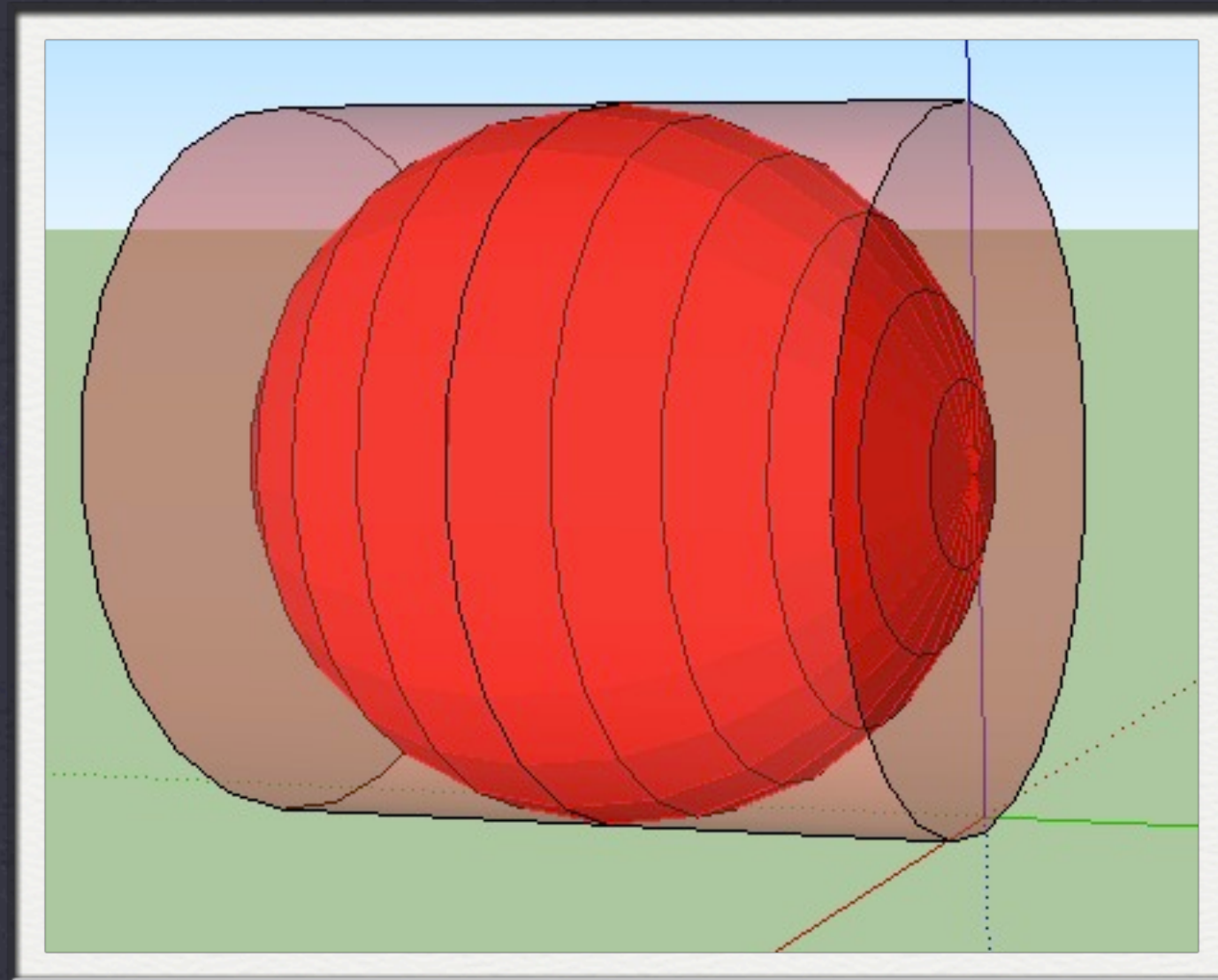
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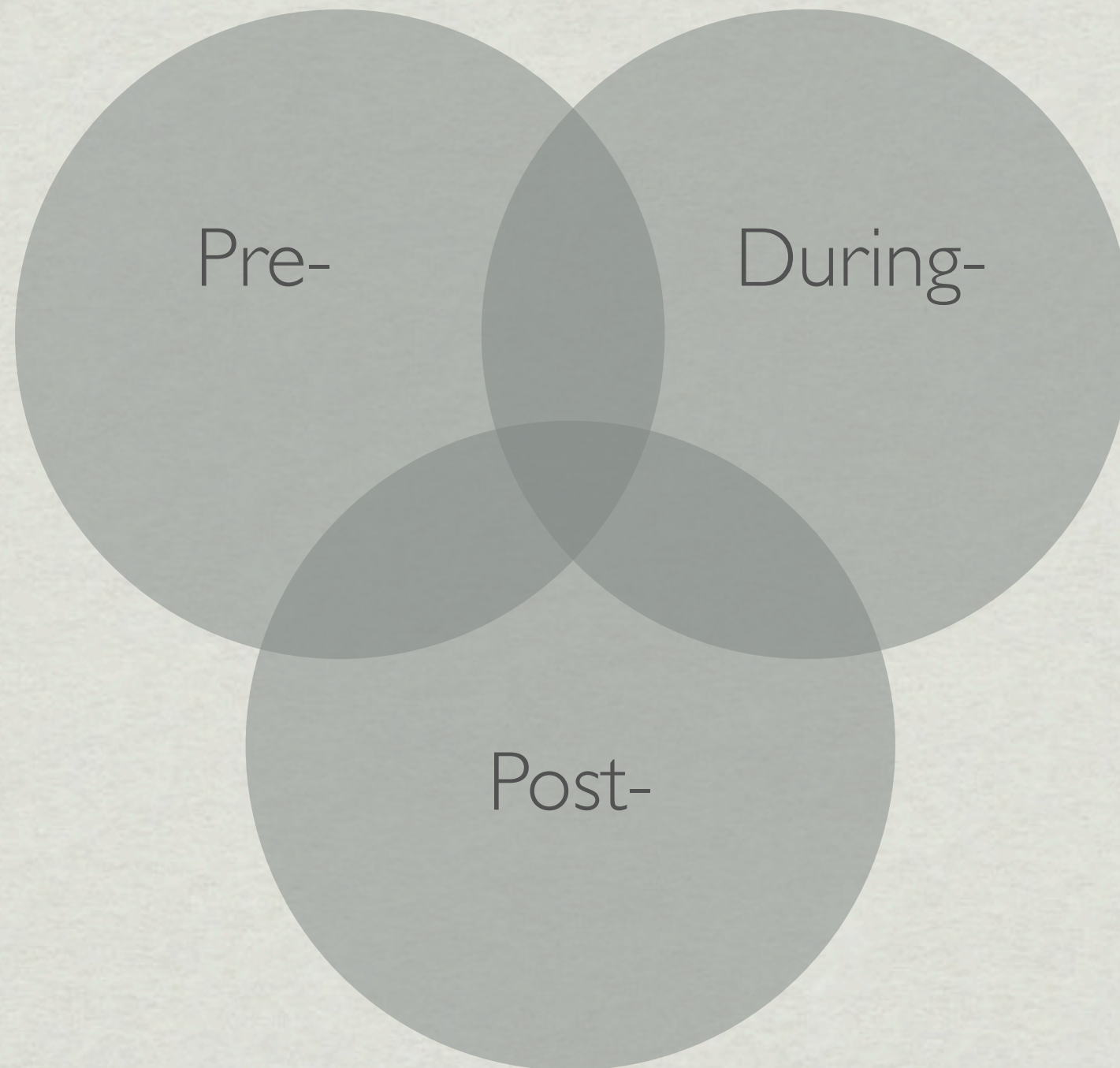
2. Common Attributes

Texas - Traditional

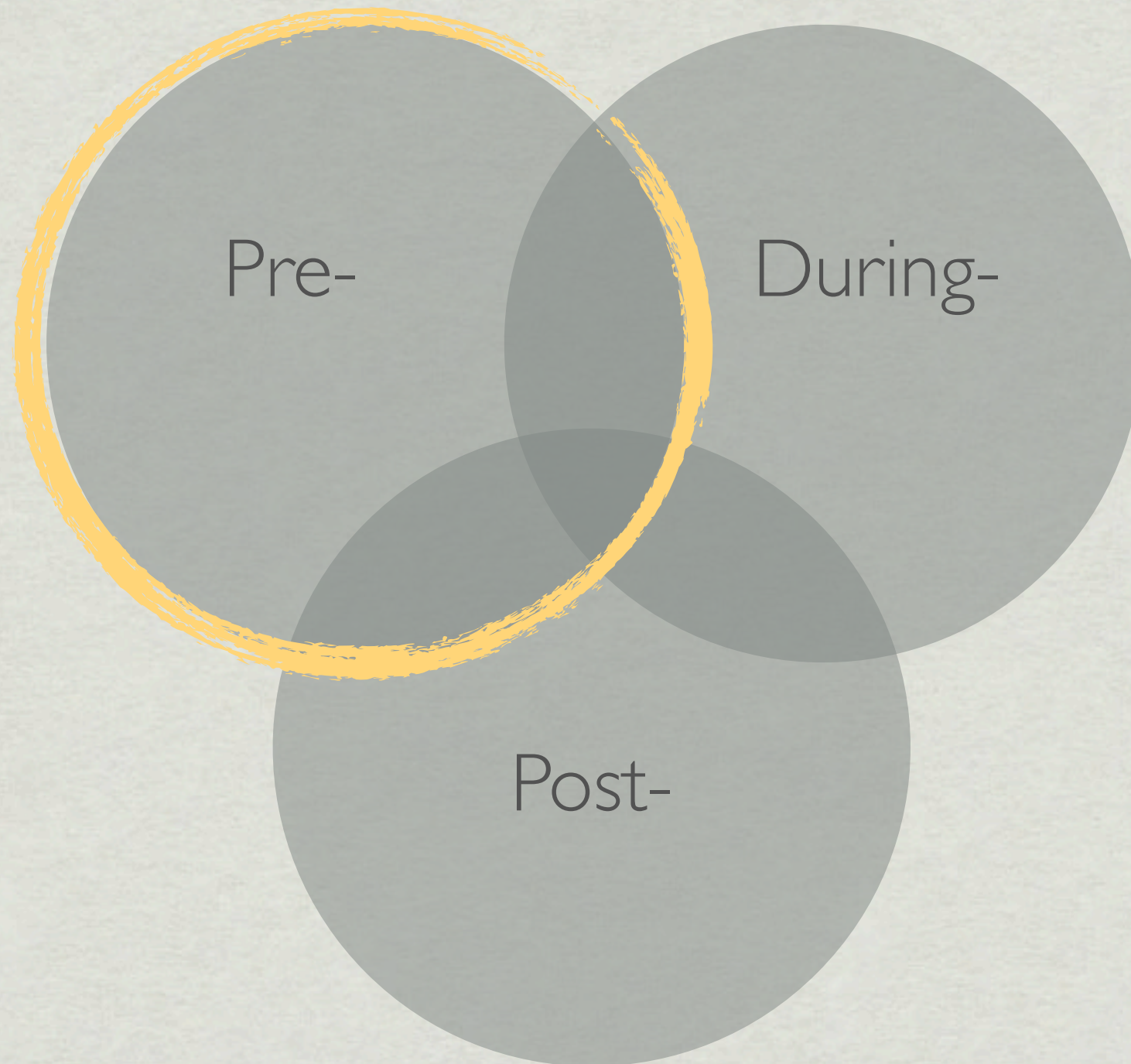
California - Alternative

Texas - Traditional		California - Alternative	
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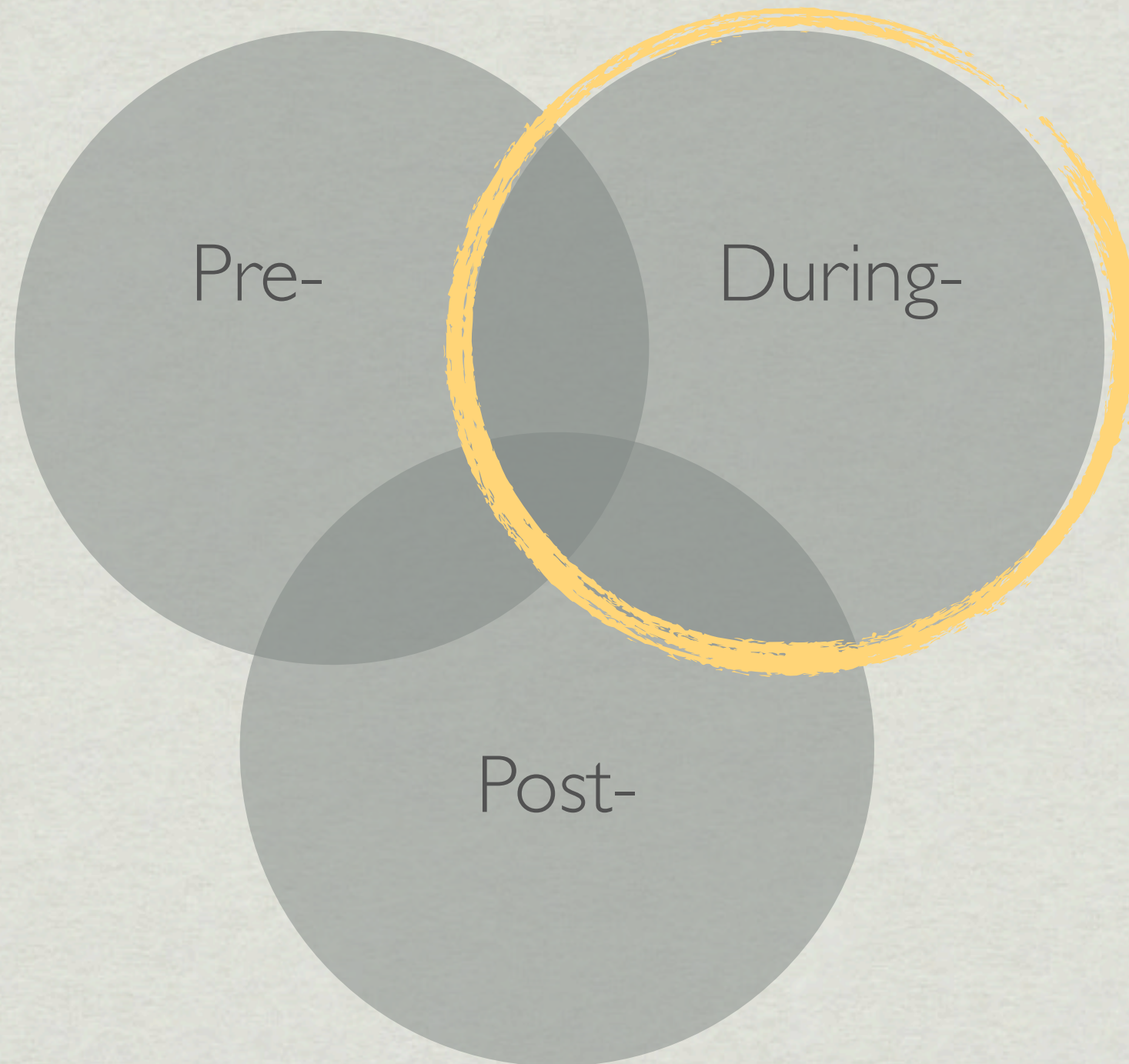
3. When?



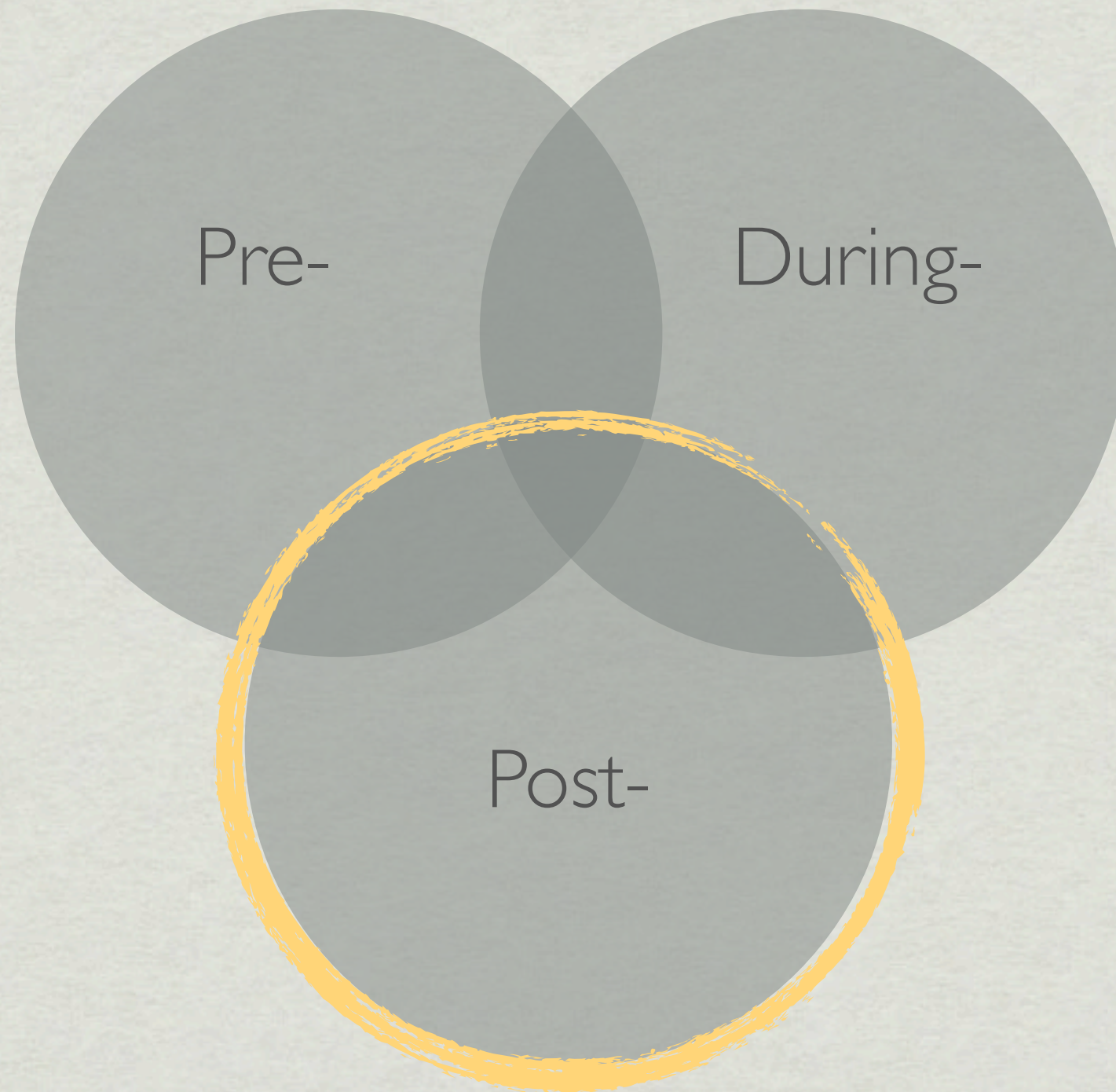
3. When?



3. When?



3. When?



Regarding Pedagogy

especially involving engaging or inquiry-based lessons

When do teachers really learn what good mathematics teaching looks like? Is it from a teacher preparation program, a mentor teacher, or a favorite high school teacher?

Regarding Pedagogy

especially involving engaging or inquiry-based lessons

Pre-UTeach

“...one of my favorite math teachers, I had her for Geometry and Calculus. And I remember cutting apart pieces of bread to figure out different math concepts in Calculus. And she even had an example of a radar gun as average rate of change. And that’s something I can still incorporate in Pre-Calculus.” [Julia]

Regarding Pedagogy

especially involving engaging or inquiry-based lessons

During UTeach

“Cause I came with the conception of, this is the way I learned it so its got to be the best way to teach it so that’s probably the way I’ll teach it. And then UTeach changed my views completely, took a 180...I think the UTeach structure completely changed my vision of what its like to be a teacher.” [Chris]

“I think the pedagogy of kids need to explore, they need to be challenged....I think the big thing is 5-E...” [Elisa]

“When I finally actually got to teach in Step I and teach in Step II, I learned that I can’t just drill it into their head...you can drill it in their head, but will kids really want it to be drilled in their head? Will they be motivated enough...” [Sarah]

“Definitely, engaging lessons...and maybe that’s just UTeach engrained it in my mind, that they’ve got to be engaged to be to maximize their learning...” [Julia]

“Okay, well the idea of inquiry anything was brand new from [UTeach].” [Erin]

Regarding Pedagogy

especially involving engaging or inquiry-based lessons

Post-UTeach

“So I think hands-on helps them remember stuff, as far as they have something to associate it with, but actually coming up with their own conclusions is still really hard.” [Erin]

“...there are a lot of different maturity levels, and some students take to an interactive lesson plan, while others abuse it.” [Chris]

“I don’t think I can efficiently do it all of the time...but [knowing the curriculum] will allow me to implement more inquiry-based [next year].” [Chris]

Modeling Instruction

“...it wasn't just here is a bunch of methods. The more, the further I went into the UTeach program, I realized that they were using the methods on us. That we were learning in the ways that they were teaching us to learn. And so I appreciated that and got to see the real impact of inquiry-based learning and the power it can have because I had been taught by so many lecture styles.” [Abby]

Modeling Instruction

"It was a Modern Geometry class...But of course, he implemented his Allen Inglesness of it...Because he's always thinking...How can you change this into teaching?"

Modeling Instruction

"So many great professors. Debbie Davis...she is just so inspiring, and talk about positive, I'm going to cry thinking about her. Her positive energy, and her belief in her kids." [Abby]

Modeling Instruction

The statements made by UTeach faculty frequently “[rang] in [their] ears” throughout the first year teaching.

Modeling Instruction

“And so people like Allen Ingles and Garrett Locke at UTeach, not so much...their classes, but more witnessing them teach their classes made a huge difference.” [Elisa]

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FLEXIBLE

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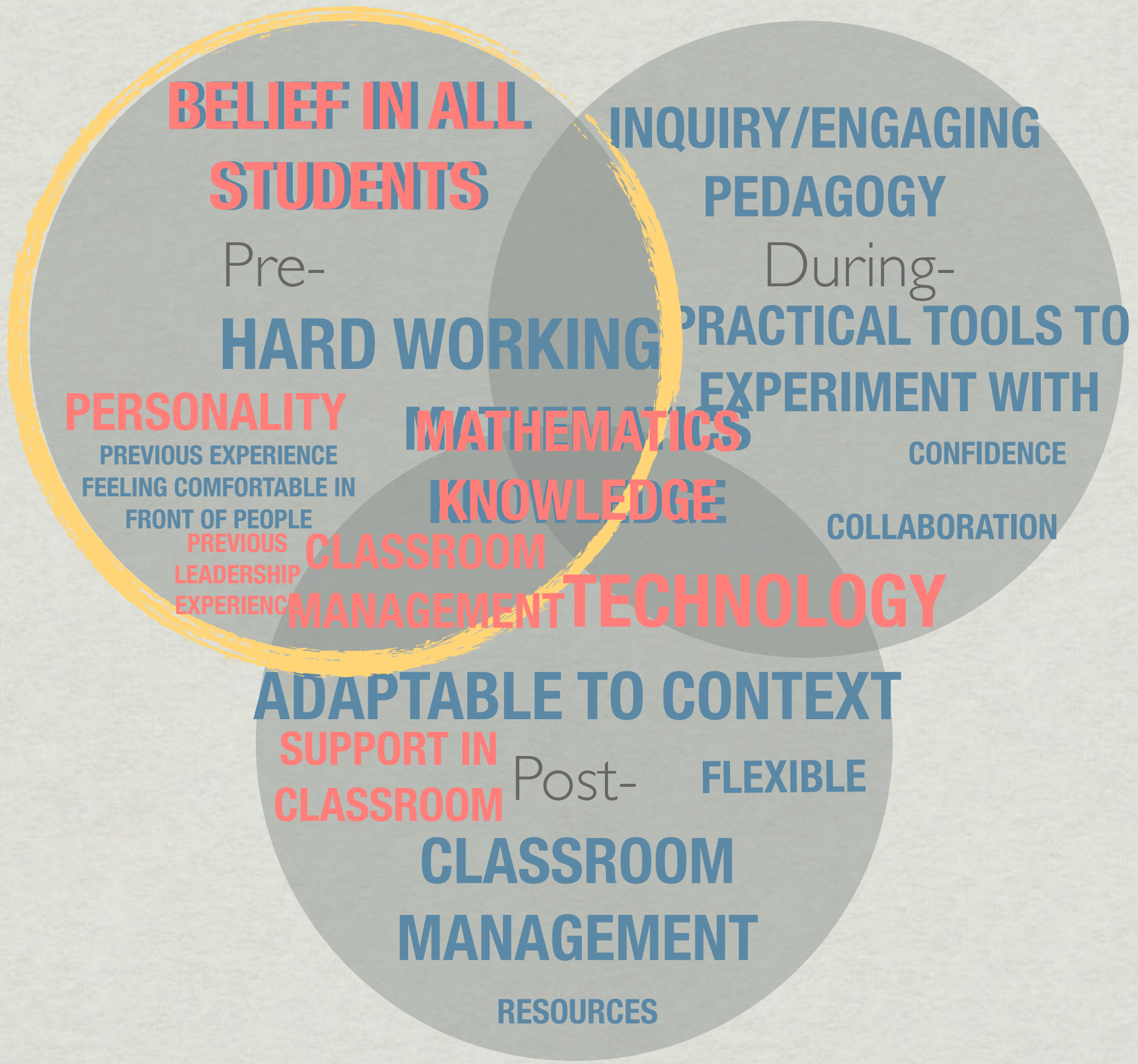
During-

PRACTICAL TOOLS TO

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Implications

