Contextualize to Learn:
Preparing Faculty Toward Math Contextualization for Student Success in Advanced Technological Education

Cross-Institutional Meeting

November 17, 2017

NSF Award No. DUE-1700625

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Agenda

10:00-10:15am	Arrival and welcome
10:15-11:00am	Research highlights – UW-Madison
11:00-11:45pm	Presentation and reporting – Milwaukee Area Technical College
11:45am-12:30pm	Lunch and brainstorming session
12:30-1:10pm	Shared resources: Online platforms to support communities of practice
1:10-1:50pm	Presentation and reporting – Madison College
1:50-2:30pm	Discussion
2:30-3:00pm	Wrap-up and plans for Winter/Spring 2018

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Research Highlights—What do we already know from prior work on math contextualization?

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Background: Why are we here?

- Math competency as one of the strongest predictors of educational and career success among community college students in STEM (e.g., Calcagno, Crosta, Bailey, & Jenkins, 2007; Hagedorn & DuBray, 2010; Tyson, 2014).
- Math remaining a major area of struggle
  - 60% of beginning community college students underprepared for college-level math (Bailey, Jeong, & Cho, 2010).
  - Math course completion rates around 30% for remedial math (Bailey, 2009) and 45% for college-level courses (Bahr, 2008).
- Underrepresented students, such as females, racial/ethnic minority students, and low-income students, report low motivational beliefs to succeed in math and STEM fields (e.g., Trent, George-Jackson, Walker, & Baber, 2010).

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Contextualization as a Promising Approach

- Contextualization defined as "*a diverse family of instructional strategies designed to more seamlessly link the learning of foundational skills and academic or occupational content by focusing teaching and learning squarely on concrete applications in a specific context that is of interest to the student*" (Mazzeo, 2008, p. 3).
- Can be especially beneficial for CC STEM students where math is mostly used as a problem-solving tool (Career Ladders Project, 2016; Seidman, 2008).
- Much practical work in place (e.g., NSF, Carnegie)
  - Contextualizing Career Technical Education in Math: A Community College and High School Project [Clair & Gardner, 2012]
  - Contextualizing Career Technical Education in Math [Bradford, 2014]
  - InnovATE project [Palm Beach State College, n.d.]
  - Carnegie Foundation initiated Math Pathways focusing on math contextualization through Statway (college-level statistics) and Quantway (quantitative reasoning)

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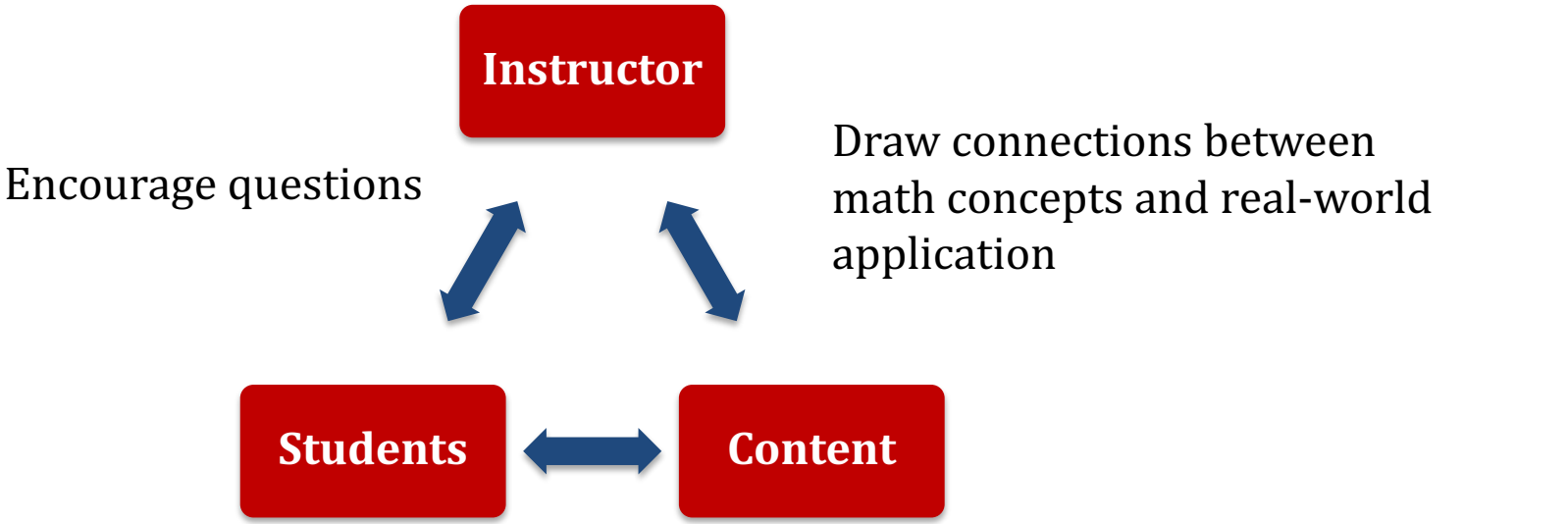
Findings from research on math contextualization

Wang, Sun, & Wickersham (2017), published in *Review of Higher Education*

--Classroom observations: "Interaction" as key to contextualization



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Findings from research on math contextualization

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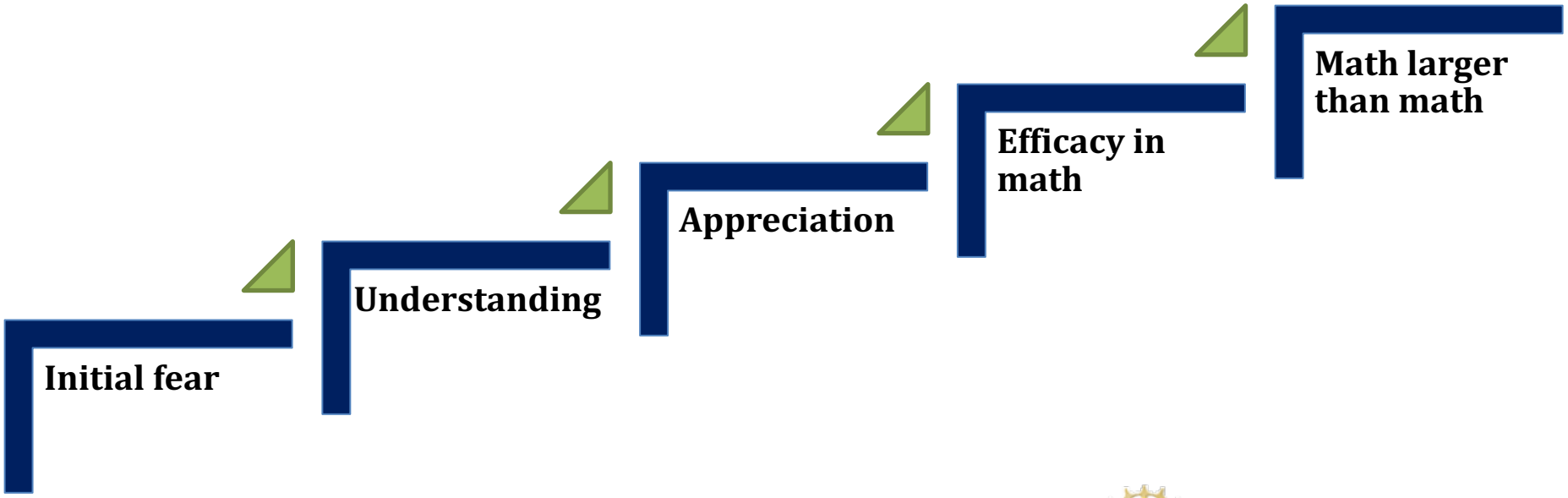
--How contextualization works to improve performance and motivation



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Findings from research on math contextualization

Wang, Sun, & Wickersham (2017), published in *Review of Higher Education*

- **Instructor as the change agent in contextualization**
  - Instructor being accessible and approachable ensured the authenticity of contextualization
  - Personalized teaching and learning opportunities
- **Peer learning and support**
  - Alternative sources of support
  - A sense of community
- **Potential challenges and their solutions**
  - Communication and collaboration among instructors
  - Professional development opportunities
  - Formal and continuous relationships with employers

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Research Highlights—What are we finding from the C2L research to date?

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At a Glance: Faculty Survey and Interview Data

- Faculty reporting positive experiences around the contextualization process.
- Variation in exposure to contextualization and progression through professional development activities has faculty reflecting on and making meaning of the approach.
- Interest in integrating it into lessons and/or courses.
- Emerging challenges around contextualization.

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What is contextualization? Wrestling with meaning

"Well you can wrap a story around a math problem or include a math problem in a story kind of thing and in context is the story, what I call the—you have to wrap some words around it, that's just the simple way of saying it."

"I mean contextualization really it means having the context drive the lesson rather than vice versa, right? It's not an example problem. It's a problem that leads to whatever the content is that you're—if you make that inversion, then everything flows from there."

"…where we give them the question, but then lead them to the answer…to help them see the mathematics in the world around them as opposed to just, hey we just made up this ridiculous word problem that you're never gonna encounter in real life."

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Contextualization: Taking it to the next level

"I've thought a lot about just relating things to the "real world" or people's lives or a job, but I'd never thought about it in those terms. And I think one thing that I—that made it more real or useful for me during the training is the idea of—I guess like bringing things into the classroom that students can interact with and letting them interact with each other to learn, explore ideas, rather than just me talking in front of a room of people."

"...it's not just about making the problem, you know, word problems have something to do with their field, but it's really about engaging people from the beginning, not giving the answers first and then expecting people to just repeat procedures. It's really about getting people to solve problems and think about what kinds of information is needed, what do I do with these numbers, which numbers are important, which numbers are not."

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Challenges around contextualization: Where is the time?

"It's time. It's a lot of time…"

"I believe that the time it would take for just one lesson is not time that I currently hold, but it is time that I'm making for another class right now, and so it's just a matter of at what point is that time available for more materials."

"Well the hardest thing about contextualization is—I mean, well anything can take an infinite amount of time, but I think it takes a long time to do it right…and I don't know how long that contextualized lesson was, maybe a week, but that's like 100 hours of work for 3 hours in the classroom…"

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Challenges around contextualization: Competing curricular strategies

"I've been flipping my classrooms where they have to watch a video and do homework first and then we talk about it in class…so I'm not ready to say, "Okay, I'm ready to move on." I still need to assess that kind of thing. Yeah, so it probably just not in my cycle yet."

"I have a large Calculus project that I've been working on with all of my prep time this semester so I do better and I am able to provide more students when I stay focused on one particular project at a time, and so this is something that I have put my hand up and said, yes I'd like to learn more about this, but it's not something that I have yet been able to provide time to doing something…"

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Challenges around contextualization: Identifying candidate courses

"I do see it happening more at the lower level, in part because they aren't moving up the ranks in mathematics. …A lot of times students find themselves in these lower level math classes because the traditional route never worked for them. If it had, they wouldn't be in these lower levels and so by making things more accessible at those lower levels, hopefully we'd be creating some of the neural pathways in their brain to make the higher level more understandable to them…"

"As you go higher levels [in math], yeah contextualizing is nice, but gosh, we have to cover so much you would have to change the curriculum. You would have to change like the Pre-Calc class, if you were doing it contextualized I don't think you would get half of the content taught so that they can go to the UW and compete with the other people that are getting taught in a traditional way."

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Presentation and Reporting: Milwaukee Area Technical College

- Progress to date:
  - Initial workshop was offered on Aug. 1 and Aug. 2, with 27 faculty having participated. Survey results were analyzed by UW-Madison and shared with MATC.
  - Culminating workshop was offered on Oct. 27, with 11 faculty having participated. A short survey was developed by the faculty lead in addition to the survey provided by UW-Madison, indicating some level of interest from the participating faculty to continue involvement https://docs.google.com/a/gmatc.matc.edu/spreadsheets/d/1n3usvx6KNYCBRAjwxcAvQNRwDcP0_yKaMLtSX5li2II/edit?usp=sharing
  - Faculty survey undergoing analysis and reporting.

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Next Steps: Milwaukee Area Technical College

- Faculty lead will organize the Community of Practice based on the results from the short survey and UW-Madison survey.
- Faculty activity tracker developed to help faculty track their activities to earn professional development credit.
  https://docs.google.com/document/d/1wzqJTMuwRknEjuUPI1Kg76acyRayJzRV8SwQOiGMMJI/edit?usp=sharing

  https://docs.google.com/document/d/15cpKegmNSlRqKr-4h87fgQzgQKwTLCBdgfl6UB_ncU/edit?usp=sharing
- Faculty lead will contact faculty who participated in the workshops as well as those who did not to continue and expand the efforts of developing lesson plans using the contextualization method.

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Lunch and Brainstorming Session

- Reactions to earlier findings and reports
- How do institutional structures help or hinder professional development?
- How do we empower faculty to participate?
- What strategies for recruitment and contextualization have been most successful?

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Online Platforms for Communities of Practice

- C2L website (https://c2l.wceruw.org/)
- Madison College Desire to Learn platform
- Milwaukee Area Technical College

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Presentation and Reporting: Madison College

Bethany Sansing-Helton
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Tony Cina
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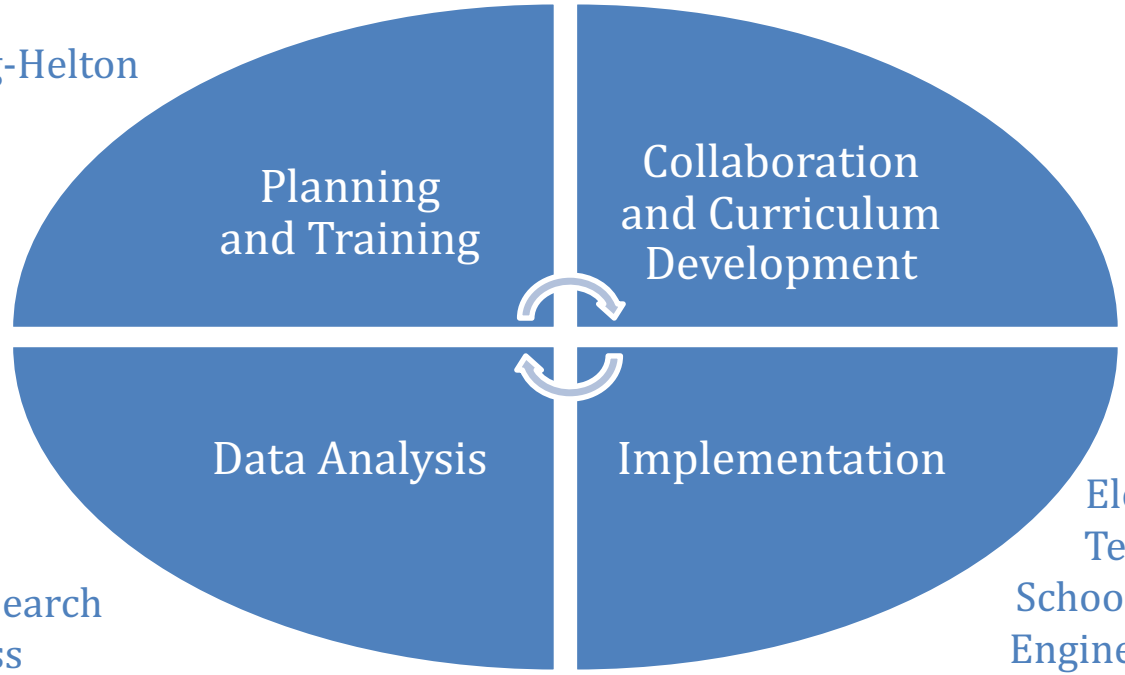

Zong Her
Project Leader
Institutional Research
And Effectiveness

Ann Thompson
Electrical Engineering
Technology Instructor
School of Applied Science,
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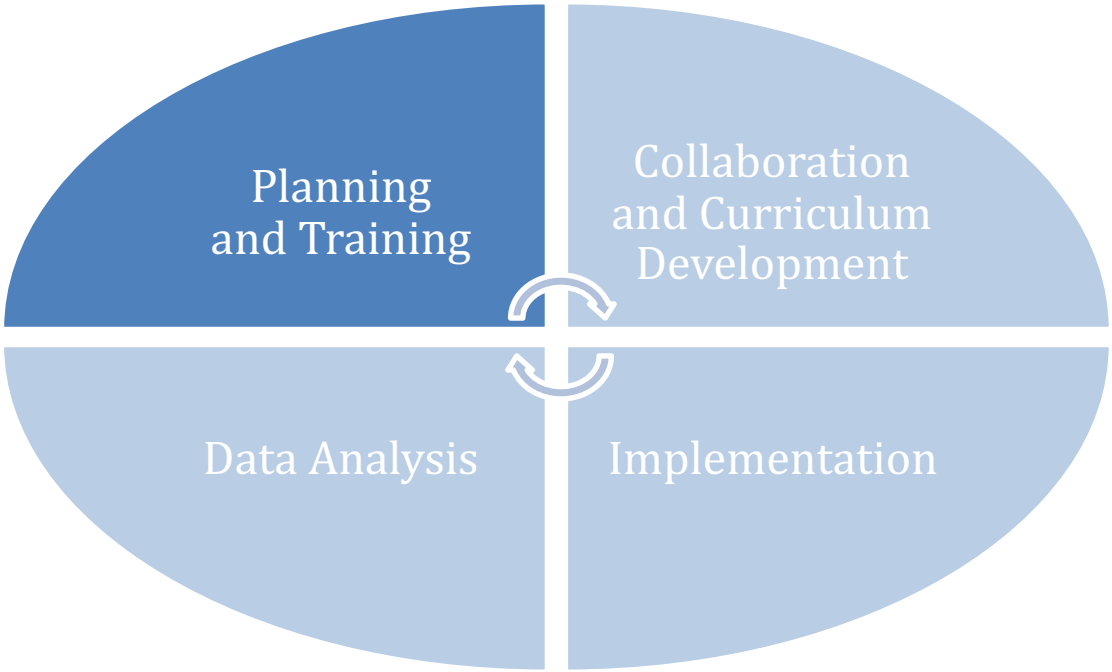
Madison College



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Planning and Training

- Recruiting
  - Goal: 10 faculty each from three schools
    - Arts & Sciences Math Department (A&S Math)
    - Academic Advancement Math Department (AA Math)
    - Applied Science, Engineering, & Technology (ASET)
  - Achieved: 32 faculty
    - 18, 6, and 8 from each school, respectively

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Planning

- Met virtually with Ann Edwards (Carnegie Math Pathways) and Eugene Milman (Borough of Manhattan Community College)
  - Developed agenda for training
  - Ensured materials were in place
  - Supported Ann and Eugene during training
- Created Blackboard site for the Madison College learning community

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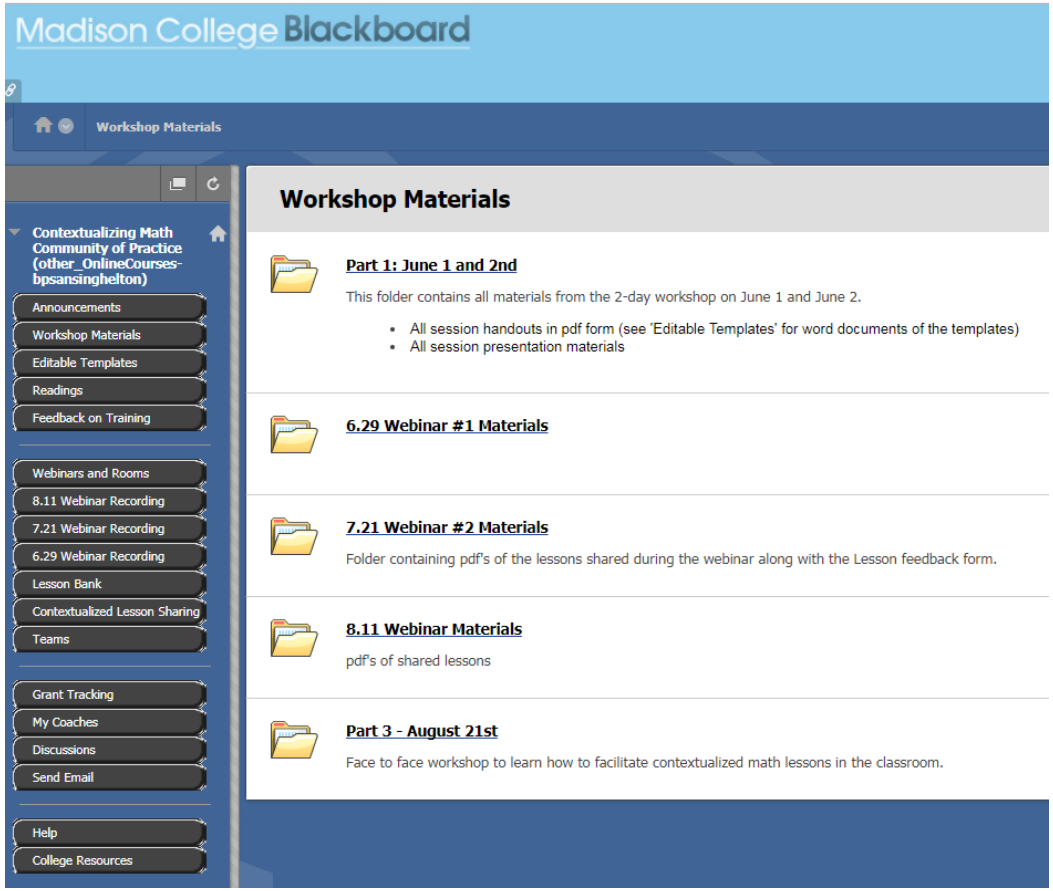
Blackboard – An Online Collaboration Space



Training Design

- Part 1 (Early summer: An initial two-day workshop)
  - Led by Ann Edwards & Eugene Milman
  - Contextualization approach:
    - Utilize pre-existing contextualized lessons as a basis for faculty to create their own contextualized lesson.
    - Focus on the 'problem cycle' design
  - Some community building activities built in to help create a Community of Practice.

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Training Design

- Part 2 (During summer: Follow-up webinars):
  - Facilitated by coaches and other Madison College team members
  - Faculty shared lesson designs through engaging with the webinar facilitators and other participating faculty.
- Part 3 (End of summer: A one-day implementation workshop):
  - Facilitated by Bethany Sansing-Helton
  - Faculty experienced contextualized lessons through video demonstration and Ann Thompson facilitating a lesson.

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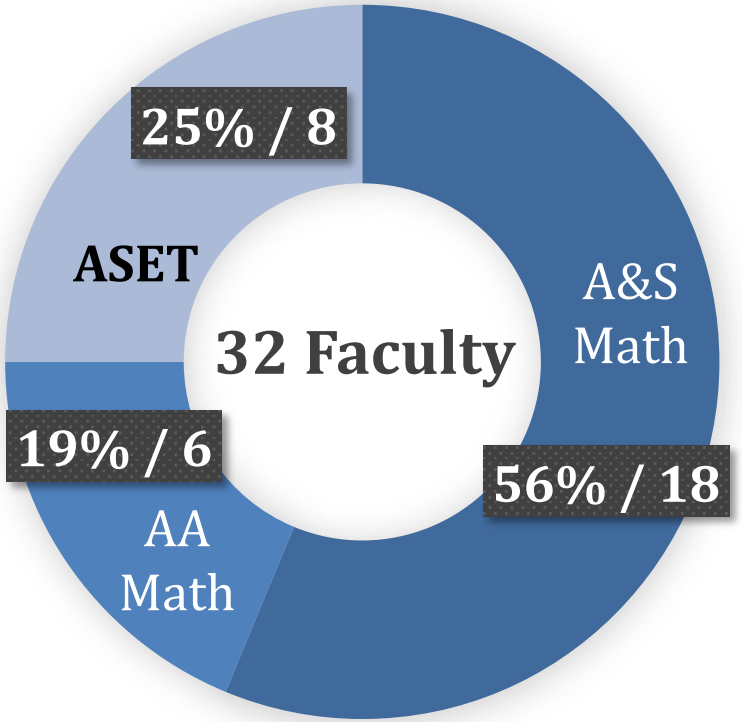
Training by the Numbers

Participation Breakdown by Madison College School



**all faculty participated in at least one part of the 3-part training*

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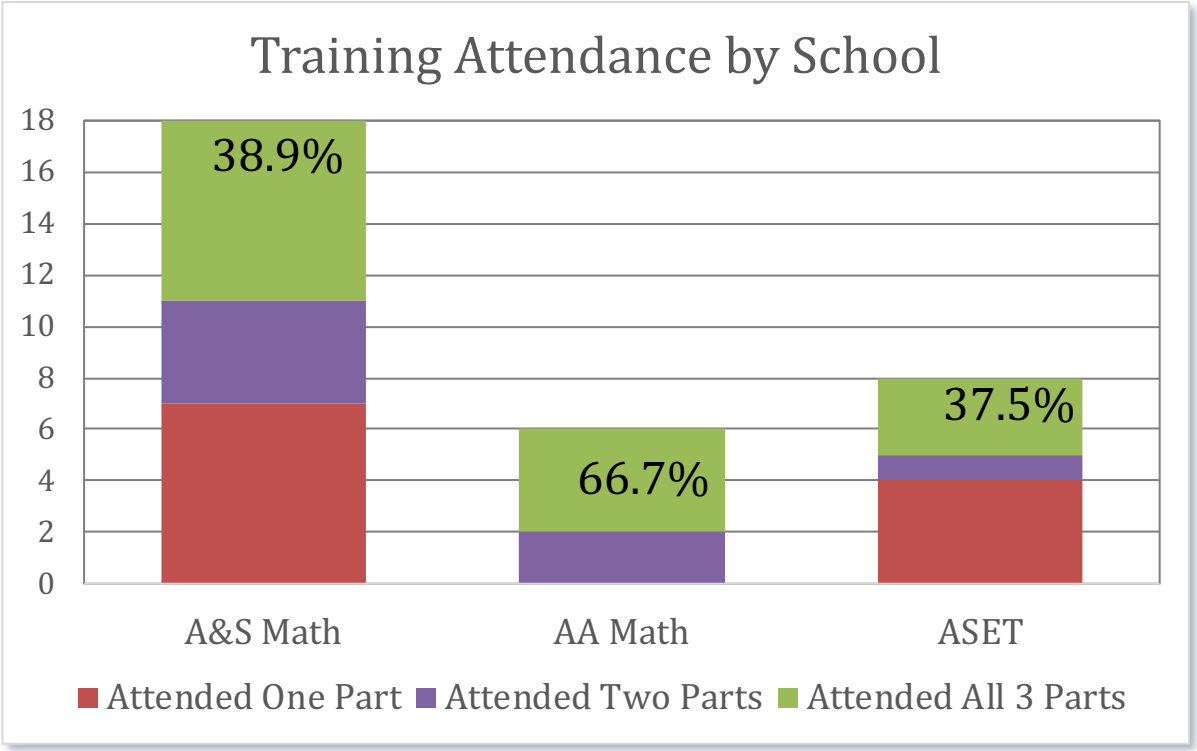
Training Attendance

43.8% of ALL faculty (14 out of 32) completed all 3 parts of the training



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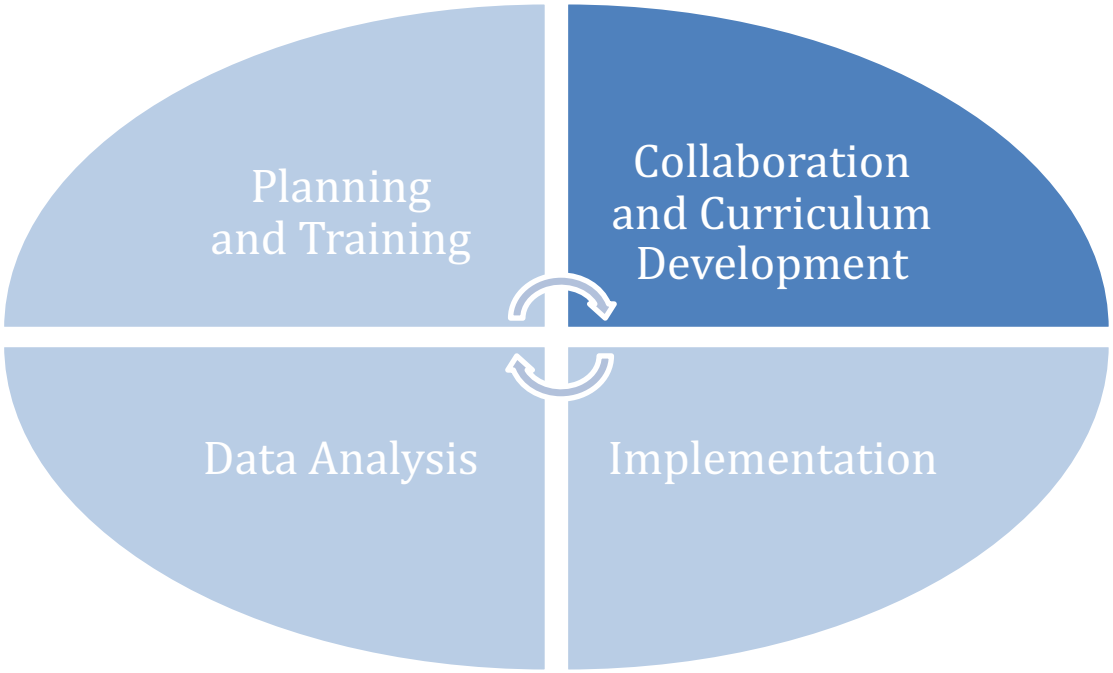

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The Training Experience

- From the perspective of a math faculty member teaching developmental math
  - Bridge programming contextualizes math to support students in specific programs
    - Manufacturing
    - Construction
  - Fantastic opportunity to work with full- and part-time faculty both within and across schools.
- Personal and professional ties developed and strengthened
  - First structured effort to collaborate across schools
  - Excellent discussions of the role contextualization can play in linking the work done in all three schools

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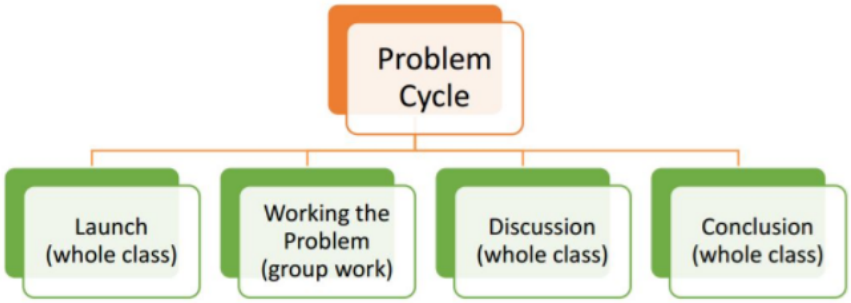
Training Reflections

- The Problem Cycle
  - Useful, manageable structure for developing contextualized math lessons
  - Far more than surface-level contextualized word problems



  - Approach is centered around using contextualized situations to teach concepts
  - Different from a traditional approach that focuses on teaching concepts and then using word problems to reinforce the concepts

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Training Reflections

- Practical examples from the training
  - Provided concrete models to use in developing lessons that were truly contextualized
- Led to exploration of Dan Meyer '3-Act-Math' tasks (presented in the summer Webinar #1)
  - Similar lesson structure as the problem cycle
  - Can provide brief contextualized introduction into a concept
- Additional benefit came from interacting with faculty from other schools
  - The math needs of ATE students drove the conversation

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Curriculum Development

- Contextualization training and implementation has led to a fundamental shift in emphasis into all the courses I teach.
  - Math contextualization has added a richness to my developmental courses.
  - Developmental courses, because of their emphasis on basic skills, can quickly become monotonous.
  - Contextualized lessons are engaging and provide a way to draw students into problem-solving experiences that put basic skills to work.

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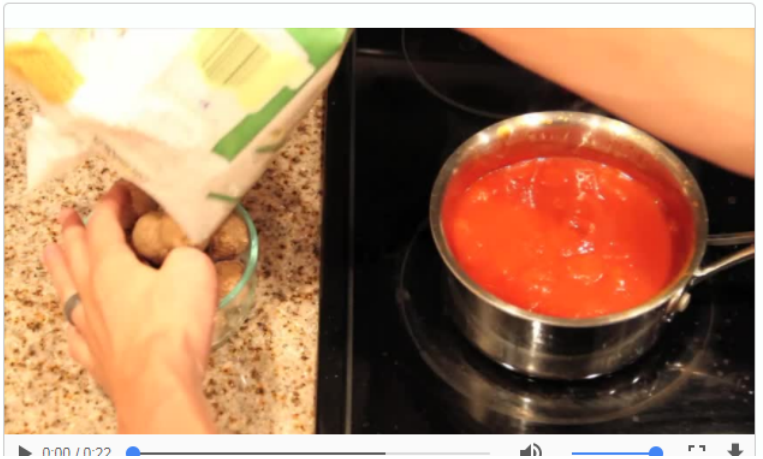
Curriculum Work

- 3-Act-Math task

1. How many meatballs will it take to overflow?
2. What is a number of meatballs you know is too high?
3. What is a number of meatballs you know is too low?



- Gear ratios lesson
  - Developed to connect students to possible careers
  - Introduce ratios to students while connecting gear ratios to automotive gears

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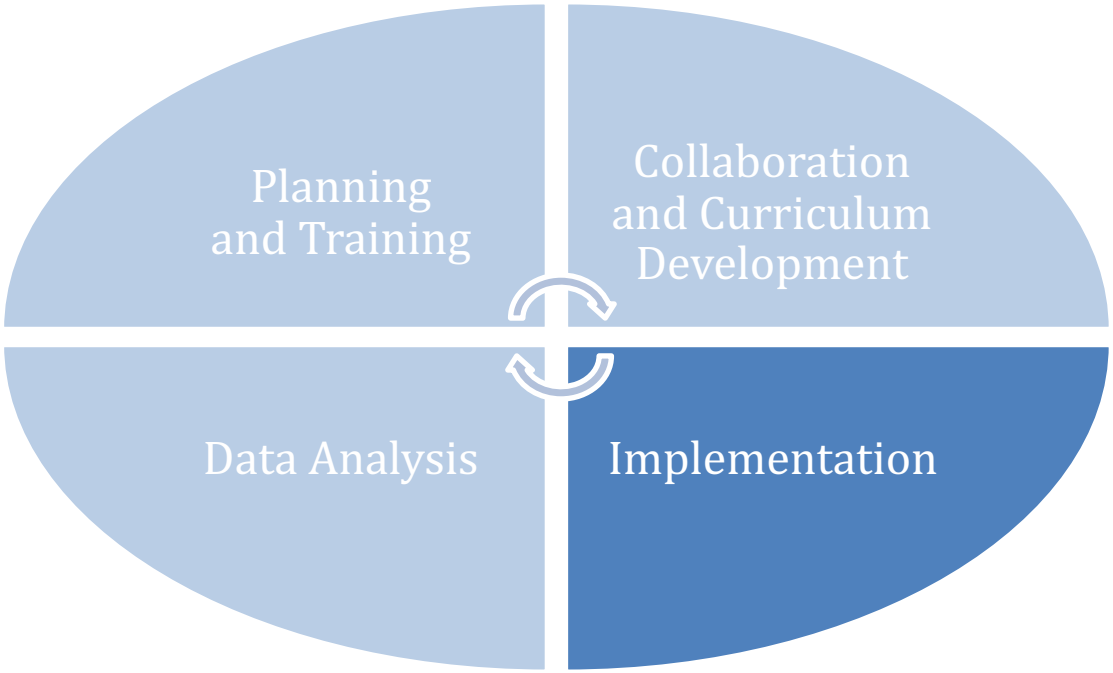

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Implementation

- Ann Thompson's experience contextualizing Electronics Math 1
  - This course is the first of a two-part applied electronics mathematics sequence. This course focuses on mathematic concepts most needed by technicians and is closely tied to the other first-semester electronics courses.
  - 8 weeks
  - 3 hours the 1st day, 2 hours the 2nd day each week
  - 22 students

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Hear from Ann

Go to the video link to hear about Ann's experience contextualizing her course.

https://youtu.be/33a9SCpQvto

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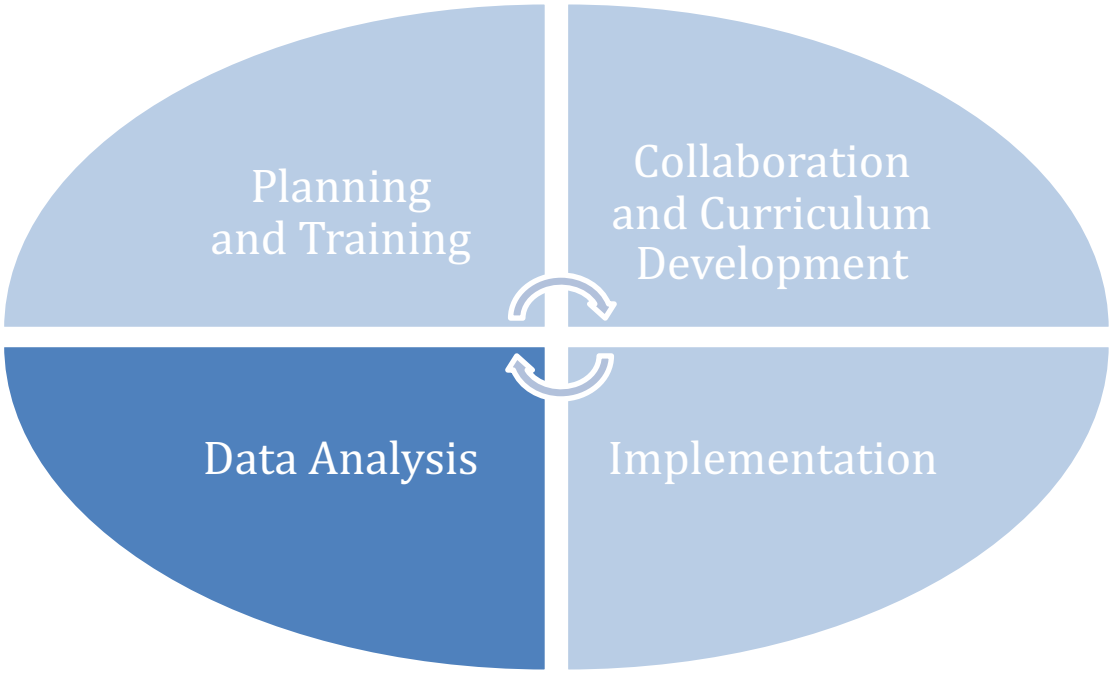

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Ann's Contextualized Course

- **Applied Electronic Math 1**
- 8-week course
- Fully contextualized 2017-18 academic year
- Students going into Math 2 – not contextualized (next semester)

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Data from Ann's class

10605171 - Applied Electronic Math 1			
All Students	**15-16**	**16-17**	**17-18**
C or Above	8 (61.5%)	10 (71.4%)	19 (86.4%)
D or Below	2 (15.4%)	3 (21.4%)	1 (4.5%)
Withdrawal	3 (23.1%)	1 (7.1%)	2 (9.1%)
Non-Minority			
C or Above	6 (60.0%)	6 (75.0%)	15 (88.2%)
D or Below	2 (20.0%)	1 (12.5%)	0 (0.0%)
Withdrawal	2 (20.0%)	1 (12.5%)	2 (11.8%)
Minority			
C or Above	2 (66.7%)	4 (66.7%)	4 (80.0%)
D or Below	0 (0.0%)	2 (33.3%)	1 (20.0%)
Withdrawal	1 (33.3%)	0 (0.0%)	0 (0.0%)

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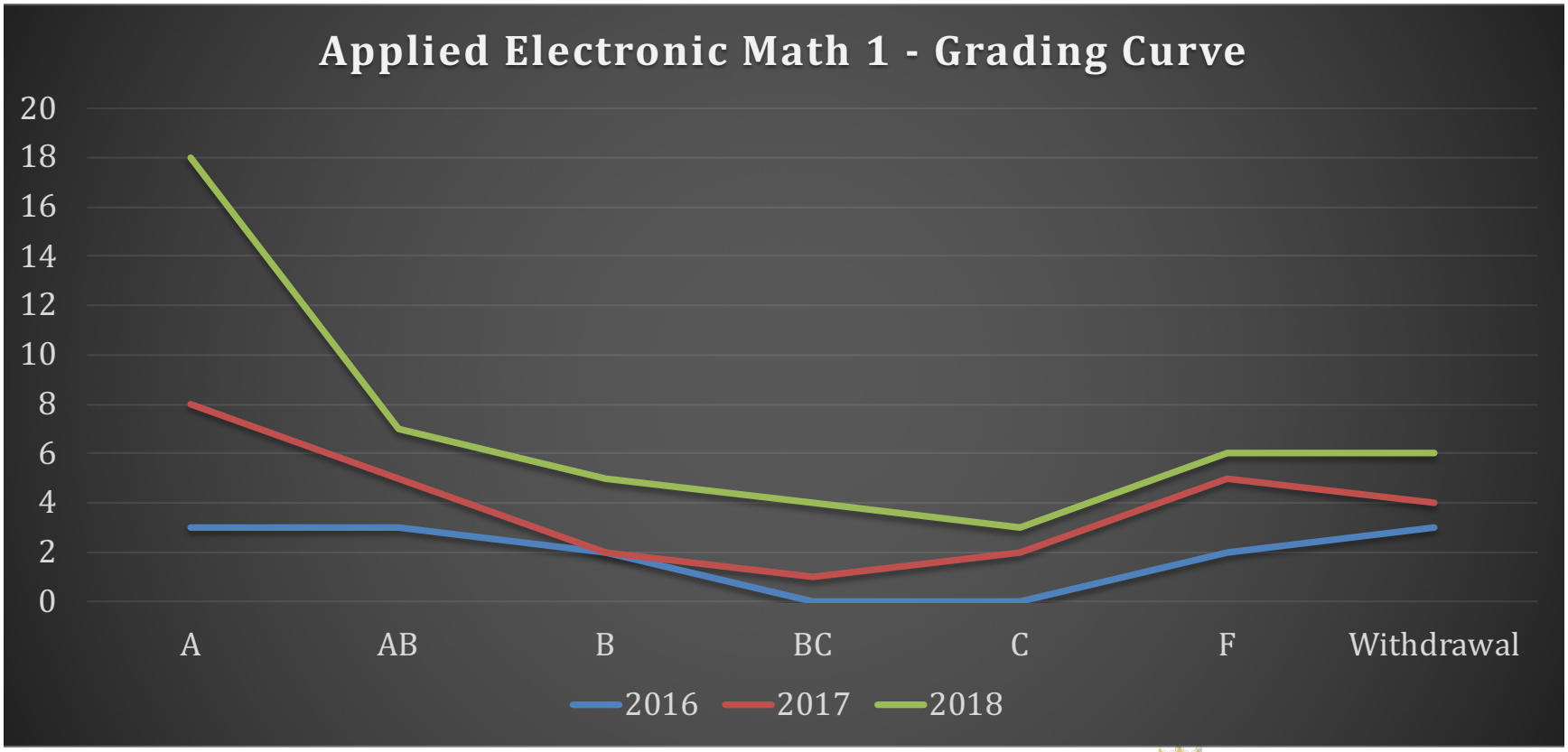
Interesting Data



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The Path Forward

- 32 faculty participated in at least one part of the 3-part training (18 A&S, 6 AA, and 8 ASET)
- 1 ASET faculty (Ann Thompson) contextualized an entire course (time written into grant)
- 21.9% planned to/have definitely contextualize(d) at least one lesson for Fall implementation

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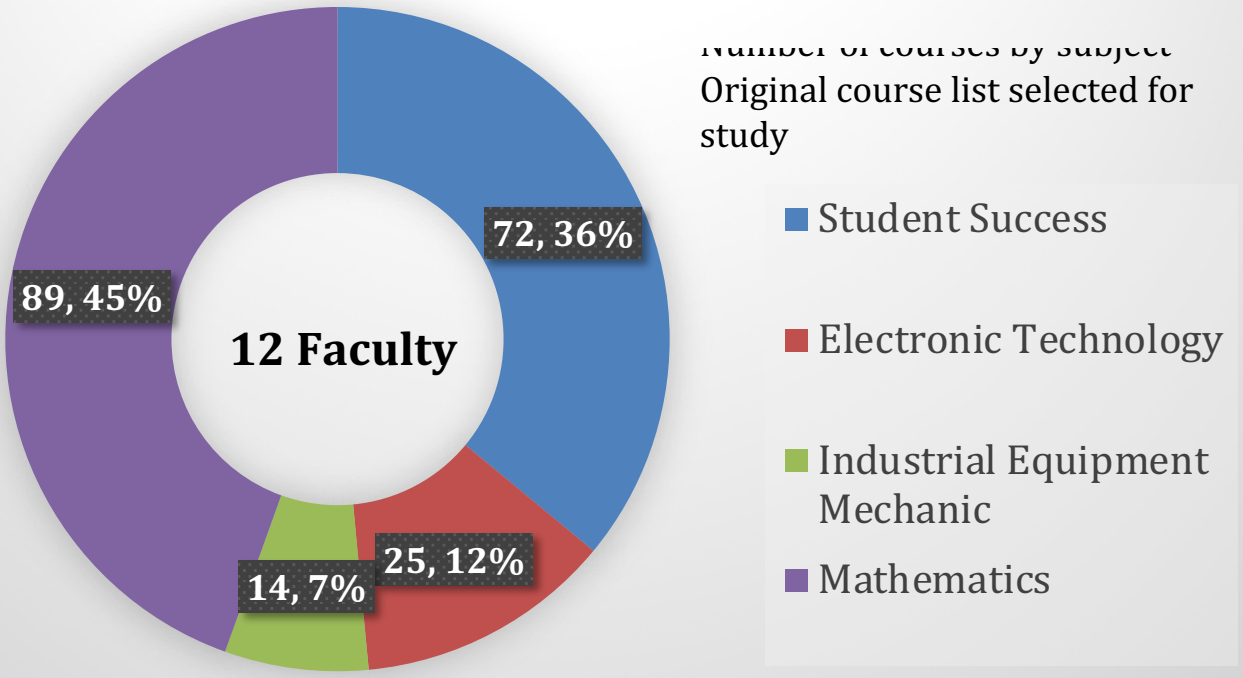
Madison Training by Numbers – Participating Faculty Courses by Subject Area



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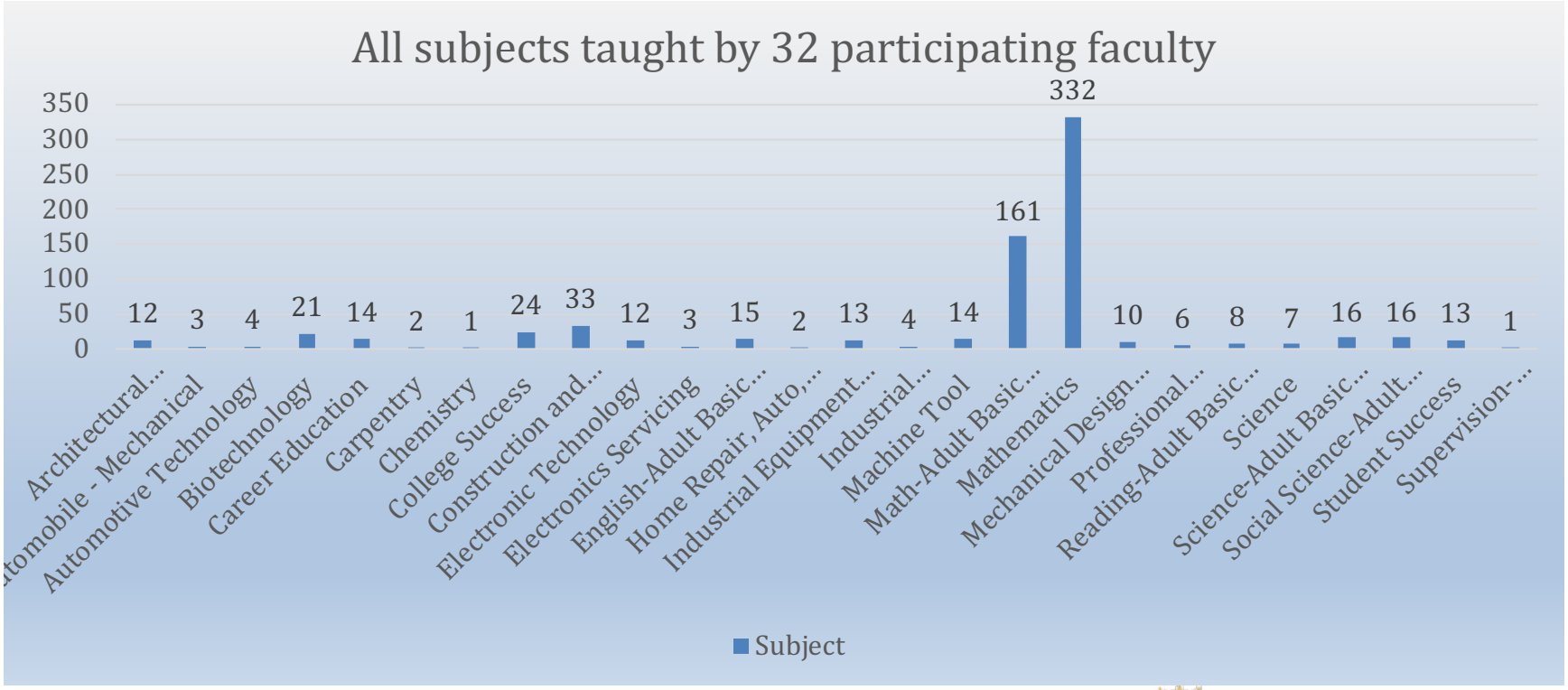

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...and repeat... Questions?

Bethany Sansing-Helton
Math Instructor
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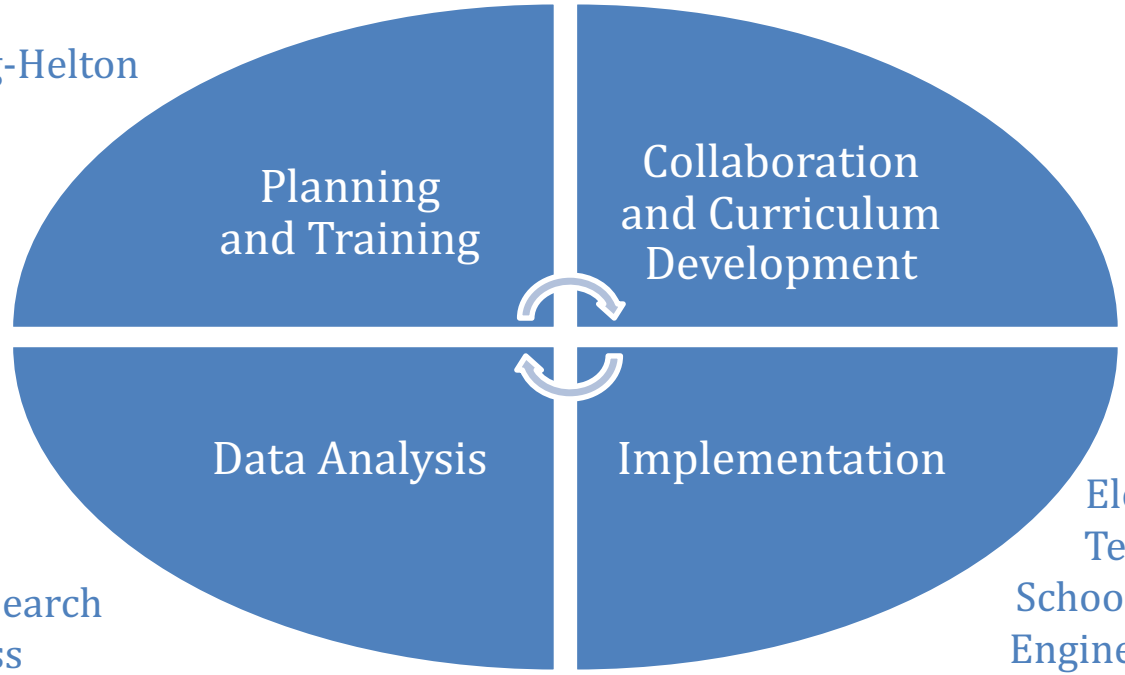

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Let's discuss: Developing communities of practice around contextualization

- How to contextualize lessons
- How to share resources
- How to structure resources to maximize usage

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Wrap-up and Planning for Winter/Spring 2018

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