University of Colorado **Boulder**

STUDENT-FOCUSED INSTRUCTION: WHAT, WHY AND HOW?

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Math Education Seminar

Nancy Kress

pronouns: she, her, hers

University of Colorado Boulder

nancy.kress@colorado.edu

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Abstract

This talk will start with an introduction and overview of what I refer to as "student-focused" instruction, including how it is similar to and distinct from what we think of as student-centered instruction. I'll present evidence for why this matters to students specifically with regard to how it supports more equitable and inclusive learning environments. We'll conclude with significant time allocated for considering how to implement student-focused instruction without redesigning your course or individualizing every assignment.

Rationale for doing this work

- Increasing diversity in mathematics has proven to be one of society's "wicked problems" (Krause, 2012; Rittel & Webber, 1973)
  - cannot be described with a finite number of characteristics or dimensions
  - not easily solved by taking a clear or well-defined set of actions

- Individual people need different things in math classes for widely varied reasons including but not limited to individual identities, cultures and past experiences in mathematics. Addressing this "wicked problem" requires that we live within this complexity.

- **Purpose of this project**: Identify broad themes, ways of thinking and/or core foundational concepts that can effectively guide the work of instructional faculty and mathematics department leaders to produce change that honors the diversity of people's experiences in mathematics.

Structure of the Study

Theoretical model of equitable mathematics instruction

Research Questions:

1. How do equity-oriented college mathematics instructors describe their instructional commitments and practices? What practices and experiences do they view as most important for developing confidence, persistence, participation and sense of belonging (*or a robust mathematics identity*), and why?

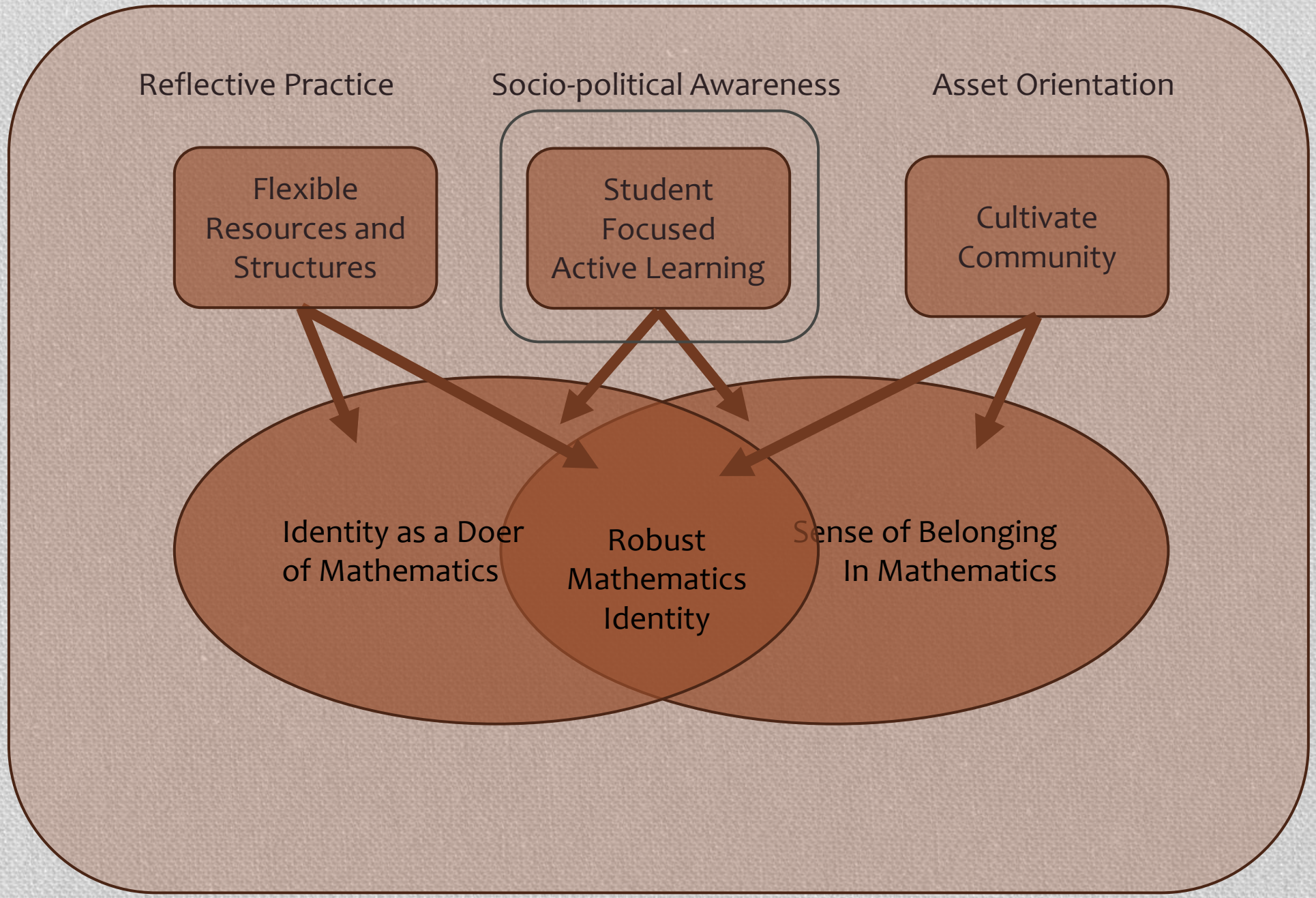
2. What instructional practices and/or learning experiences do students view as most important in supporting their confidence, persistence, participation and sense of belonging in mathematics?

Interview data:

Six instructors, three at each of two institution, half male, half female, diverse identities

Ten students, four at ECU and six at SCU, nine female, one male, diverse identities

Refined and revised model of equitable and inclusive mathematics instruction


Reflective Practice
Socio-political Awareness
Asset Orientation
Flexible Resources and Structures
Student Focused Active Learning
Cultivate Community
Identity as a Doer of Mathematics
Robust Mathematics Identity
Sense of Belonging In Mathematics

Students on EMI: Flexible Policies and Structures

(Mastery Based Grading)

Jordan: "I had never been introduced to a setting like that. It was always pass or fail at the end of the semester. If you fail, 'sorry for your loss. If you pass, you did an amazing job.' It was never, 'we understand that you need time, and you need help, and we're going to give that opportunity to you.' So, when that happened, um, it kind of seemed too good to be true. I was like, 'wow, I'm going to have a no credit on the [transcript] instead of an F or a C or a D.'" (Jordan 74)

Students on EMI: Community

Cameron

"It's nice to be recognized like that by a teacher, not just like about the class itself. Because I feel like with other teachers it's just about whatever the subject might be. And like, they don't really care about your personal life, or like what's going on that might make you do bad on a test." (Cameron 90)

Students on EMI: Department Culture

Robin

"You could reach out to other professors. You could reach out to the LA, even if they're not in your class or your class time, the, math department is pretty welcoming and they're not really like shun, anyone, you know, for asking stupid questions. Cause like, that's the thing they're trying to break or dissolve this stigma, around math that you have stupid questions or, um, people just aren't good at math, they just try to, they try to, that's not welcome in math. It's just like, 'let's go let's do this!' So, I think the math department does a great job at trying to or attempting to dissolve that stigma around mathematics." (Robin 126)

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Student-Focused Instruction:
What, Why and How?

WHAT IS STUDENT-FOCUSED INSTRUCTION?

Student Centered Instruction

- Students' voices are heard more than the instructor's voice and/or students are actively participating in the doing of mathematics
- Focus often remains on instructor's ideas, understandings and methods
- Questions, problems and solution strategies are still conceived of and posed by teachers

Student Focused Instruction

- Implies that students participate in doing mathematics in ways that focus on or begin with students' mathematical ideas and understandings
- Values students' knowledge, perspectives, ways of understanding, experiences and relevant issues in their lives
- Questions, problems and solution strategies are produced and owned by the students

Asset orientation: Instructors on “prerequisite knowledge”

Alex

“if a student, and this happens all the time in class where a student will ask a question and it's clearly based on something, they should already know, I never treat it as something that says, ‘Oh, you should have known this from previous course,’ but instead, you know, go off to the side and explain what it is or why it's true.” (Alex 274)

Asset orientation: Instructors on “prerequisite knowledge”

Dana

“I'm going with the assumption that yes, they obviously have these skills or they they've shown mastery of these skills prior to this class, but they might have forgotten, or they haven't been in a math class for a couple of years or for whatever reason. I just want to make sure that those basic skills are very honed and that we recall that information because it's not easy just to go into a class and even if, even if you had a class the previous semester from college algebra to calculus, precal, like can throw you off to calculus, you know? So, um, that's one thing I always like to do for my students to make the class more equitable” (Dana 74)

Student-Focused Instruction: Instructor Perspectives

Sam

"There's a point where there is discourse, and I was really trying to get it to be one… building off of one student's ideas to another…. So, there it's, you know, it's student to student interaction to trying to get to that, not just back and forth with me." (Sam 88)

Student-Focused Instruction: Instructor Perspectives

Jesse

"When I asked them like, 'so what do you guys think about this function? Is it increasing or decreasing?' Increasing. Okay. Even if it's decreasing, I'll go along. Okay. 'Let's think it's increasing, so what will that mean when it comes to finding the, uh, the sign of the first derivative, for example, uh, this, just take it up' and okay. We actually got to a contradiction here. 'What do you guys think?' So, um, so I will say that that, that's a way that I incorporate their ideas to the instruction. I value their ideas in, I, I tried to put them as, as a group, as something valid and, and if so, eh, let's see what we all think about it. If we keep going with that idea, um, that you might lead us to something that is incorrect and that's good to learn about that or something that is actually, it looks like it's correct. And so, either way it's good for the class. I will say for me too." (Jesse 168)

Student-Focused Instruction: Instructor Perspectives

Jesse

"So, I think an active learning classroom should have more of that, uh, of giving you opportunities or giving you opportunities to question things, to try to describe things by yourself, to test your ideas, to make mistakes and get good feedback, but don't feel bad about it don't feel on the spot or shamed by it. Um, so that might be the idea of active learning that I have in mind when I think of active learning, uh, this sort of community that learns actively and keeps your opportunities to, to make mistakes, to share your thoughts, to test your ideas to research together." (Jesse 190)

Student-Focused Instruction: Instructor Perspectives

Alex

"When a student does have a, a different approach, I try to have them explain their thinking to me. And if it's, if it's different than what we were doing in class, I try to relate it to what we were doing to either say, why is maybe just another point of view of what we were doing, or maybe it was a different approach. So, I encourage it. I never put somebody off to say, well, no, we're not going to do it that way, but I just try. Maybe if it's something that is too far off, I'll try I'll, we'll, we'll talk about it in class. If it's a class question, we'll talk about it and just indicate that that's an alternative way to what we're doing." (Alex 250)

Student-Focused Instruction: Student Perspective

Olivia

Alex "asked me like, 'okay, well, how did you, how did you get that?' **And then [they] made sense of what I did**" (Olivia 190)

But what about…

- The student who feels that they are being asked to teach themself?
  - Engagement and interaction!
  - Pointing out what they are doing that's productive and accurate, and then helping them to go farther.
- Should we ever lecture at all?
  - Absolutely! There are times when what students need to advance their thinking is new information. Instructors are the holders of that knowledge. Part of our job is to share it.
  - Just don't make it about students duplicating your strategies. Ultimately students need to incorporate the new information into their own understandings.
- Should we ever tell students if they've made a mistake?
  - Absolutely! Ideally after first acknowledging how they are thinking about things and what is productive or accurate about what they are already doing.

- Providing learning experiences to build confidence and independence.

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Student-Focused Instruction:
What, Why and How?

WHY USE STUDENT-FOCUSED INSTRUCTION?

Relating Instruction to Identity

	Examples	Supporting Identity as a Doer of Math	Supporting Sense of Belonging
Student-Focused Active Learning	Inquiry into student thinking Students explain their reasoning Instructors work to make sense of and understand how students are thinking about the math Instruction incorporates students' ideas or knowledge	Supports students' agency and authorship in how they do math	Supports students to feel seen when instructors notice their successes and struggles and offer commendations or support

Student-Focused Instruction: Student Perspectives

Martina

"[they] just, I guess, got the explanation as to how I got my answer wrong. And I felt like a lot less embarrassed. Cause it wasn't like, 'Oh, like I was going to ignore your answer. Cause it was incorrect.' It was, 'well, I want to see like how, like why'd you get it wrong?' Or 'is there any, is there anything different that you were doing?' And I was able to realize, 'Oh, I did not distribute a negative sign.' I was like, 'okay.' Like I learned my mistake and moved on" (Martina 312)

Student-Focused Instruction: Student Perspectives

Leticia

"you can explain it to them, and then that helps you… learn even more" (Leticia 322)

Student-Focused Instruction: Instructor Perspectives

Dana

“I'll see sometimes that students will do something a different way and I've realized like, this is actually easier than what I'm teaching them. So I'll change my teaching strategies because of that.” (Dana 156)

“I love seeing new ways to do things like I really enjoy it. And I really value when my students show me different ways to do things. And I tell them like, as long as you're getting the correct answer and you are understanding it, I'm very happy with that. Cause that's my that's my goal is you need, I just want you to understand, even if you, if you go the long way around, but you get there. Yeah. That's totally fine with me. You got, there is the point.” (Dana 162)

Student-Focused Instruction: Instructor Perspectives

Alex

“It gives me an idea of what, of, how they're thinking. So just sort of general listening to how they're working.” (Alex 228)

Student-Focused Instruction: Instructor Perspectives

Jesse

"So that's a, that's a good point actually, to go and ask them why, how and why not. That's another question that I think is very useful. Um, also asking them to explain things is, is a very good way for me to, to find out, not just that they remember a concept, but also about their ideas about concepts, um, because it's not like they will tell you the definition, they will actually think about it, and they might try to find a way to describe it."

(Jesse 160)

"the opportunity to hear different perspectives of the same idea. So having this chance to ask the students similar question, uh, and getting different answers, it's very enjoyable for me as a teacher." (Jesse 200)

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Student-Focused Instruction:
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HOW TO IMPLEMENT STUDENT-FOCUSED INSTRUCTION WITHOUT MAKING YOURSELF CRAZY!

Student-Focused Instruction: Student Perspectives

Olivia

“This would be correct if, if, you know, if it was asking if it weren't for this part.” (Olivia 198)

Student-Focused Instruction: Instructor Perspectives

Sam

"one thing I aspire to do is to sort of, uh, uh, recast it and pose another question and have someone else answer that, um, to either sort of extend what was said or go deeper." (Sam 108)

Student-Focused Instruction: Instructor Perspectives

Morgan

"when I say no wrong answers, I mean more in the sense of how would you explain the relationship between a logarithm and an exponent? And that's what mean when I say there's no wrong answer. So, so usually anything that they say I can pull from and say, that's great. That's a blah, blah, blah. Can anybody else expand on that? That's that's what I mean by no wrong answers. Yeah. I mean, if somebody, if I said what's two plus three and they said four, I might ask the class, do you guys agree? Anybody have any other answers? You know? But, um, that's more what I mean." (Morgan 220)

Six Essential Questions

First: A personal teaching story - The August Moment

Questions that can work as a lesson plan.

1. What do you notice?
2. What additional information or clarification would be helpful?
3. What can you do or figure out?
4. How do you know that your work and/or answer are accurate?
5. Is there another way you could approach this problem?
6. What else can you say about the problem, and what else would you like to know?

- Kress, N. (2019). Six Essential Questions for Problem Solving. In M. Pitici (Ed.), *The Best Writing on Mathematics 2018* (pp. 158–168). Princeton University Press.

Is this like Differentiation?

- It certainly works as a form of differentiation
- It disrupts the aspect of differentiation that perpetuates leveling or hierarchical ways of thinking about student knowledge – everyone brings knowledge and everyone gains new knowledge

Potential Impact on Assessment

- Students may take longer to work through problems
- Confidence and independence – willingness to try difference strategies before giving up

In Summary, equitable mathematics instruction:

- Acknowledges many factors that contribute to students' success
  - is not overly focused on students working harder
  - it's not a meritocracy

- Supports students to succeed in unison with honoring their commitments outside of school
  - adapts or is responsive to students' outside of school commitments

- Sees students' prior knowledge as a starting point and uses it to inform instruction
  - avoids placing blame for what students don't know, don't remember or haven't previously learned
  - instructors focus on fully understanding how students are thinking about the math (goes beyond inquiring)
  - positions students as knowledge holders, not solely as learners
  - students have agency and authorship over the ways they do math

Leticia

“in college actually, I've done a lot better than I've done in high school, in my math classes” (Leticia 44)