

# Encountering and Becoming Role Models: Combating Underrepresentation in STEM

SCHOOL OF EDUCATION(1) & INSTITUTE OF COGNITIVE SCIENCE(2)

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# Outline of the Talk Slide

- Context of outreach program
- Purpose of this talk
- Preliminary and key findings
- Concluding remarks

# Neuroscience Education Outreach (NEO)

Sponsored by a large public university located in the mountain west region of the United States.

Employs undergraduate students pursuing degrees in Science, Technology, Engineering, and Mathematics (STEM) to perform outreach.

Undergraduate instructors perform roles of preparing and facilitating age appropriate lessons in local k-12 classrooms.

# Purpose

To describe:

- how “trajectories of identification” emerge for undergraduate instructors as they participate in outreach
- how elements of participation affect identity and future participation in Science, Technology, Engineering, and Mathematics (STEM)
- Perceived barriers and constraints to (continued) participation in STEM



# DATA COLLECTION AND PRELIMINARY ANALYSIS



# Participants and Data Collection (2015-16)

- Participants: local teachers (n=2) and HS students (n=46), undergraduate instructors (n=11), program leader (n=1)
- Data Sources:
  - program director interview
  - 2 teacher pre/post surveys
  - 2 teacher interviews
  - 7 instructor individual interviews (6 participants)
  - 1 instructor group interview (1 overlap, 1 new)
  - 9 observations of instructors meeting and delivering outreach
  - 7 instructor surveys
  - 46 anonymous student surveys

# First Round: Data Analysis (2016)

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**Surveys** were used for quantitative analysis of instructors' (and teachers') attitudes, interests and knowledge surrounding neuroscience topics; for skills gained during outreach experience; and barriers to participation.

**Interviews** were transcribed or content logged for qualitative analysis of neuroscience attitudes, thoughts, interests, and knowledge; skills gained; and barriers encountered.

**Observations** were also qualitatively coded.

# Preliminary Findings (2015-16)

## Impact on Undergraduates

Increased confidence when teaching and presenting

Created contacts with community members and faculty

Increased interest in their own brain health

Linked neuroscience concepts to their academic and personal lives

## Impact on Youth

Foster peer-to-peer discussions

Increased interest in neuroscience topics

Students shared information they learned with their families



# Skills Developed from Outreach

(from undergraduate surveys/interviews)

- Curriculum development
- Teaching
- Public speaking
- Working with kids
- Confidence
- Teamwork
- Communication
- Public speaking
- How to stay excited and positive during a lesson
- The ability to synthesize and teach high level content at age appropriate levels
- Professional relationships for post grad goals
- Conference experience
- Class room management and more!

***All respondents saw these skills as transferring to their future careers.***



# HOW THE CURRENT PROJECT EVOLVED SINCE 2016...



# Main Research Questions

(1) How does participation in outreach mediate career and professional identity development for undergraduate participants?

(2) How do non-stereotypical\* role models develop in a university-based STEM outreach program?

\*Nonstereotypical role models refer to those positioned as leaders and role models who belong to groups historically underrepresented in STEM

# Analytic Framework


*Based on Polman & Miller (2010)*

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Analytic Elements	Questions We Ask:
Positioning (Self & Other)	How do people reinforce or resist positioning of themselves or others as professionals in STEM, and in relation to the STEM field?
Prolepsis	How do people make connections to their own past, present, and future lives (or of others like them)? What are the stories they tell & imagine?
Place or “Scene”	How does the outreach program embedded in a large university welcome and support, or not, various types of people? Expectations for various “ways of being”?

## Second Round: Data Collection & Analysis (2017-18)

- Previously shown data with addition of,
  - 2 undergraduate instructor follow up interviews (2017)
  - 5 follow-up interviews with undergraduates (2018)
- Case Study Analysis
  - Second Round of Coding (from Analytical framework)

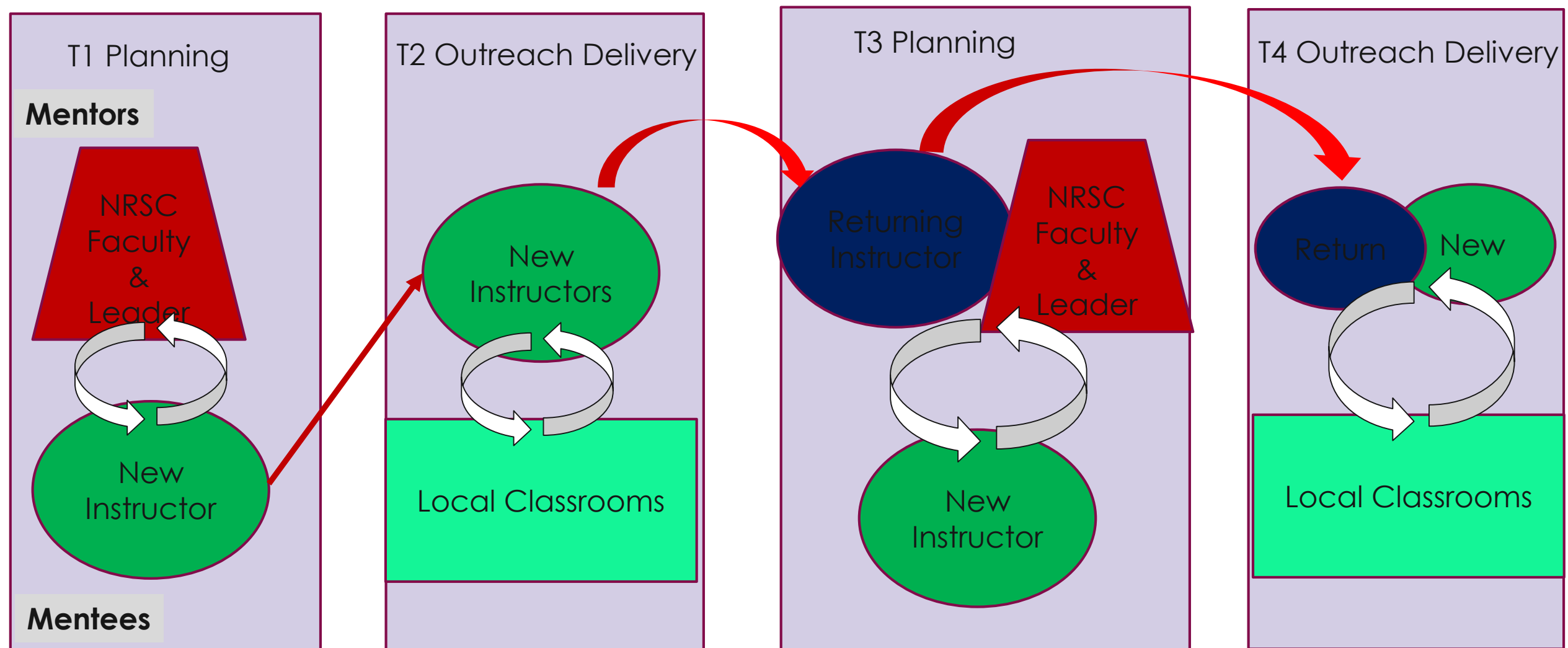


# OUTREACH MODEL AND PATTERNS OF CASES FOR UNDERGRADUATE PARTICIPANTS



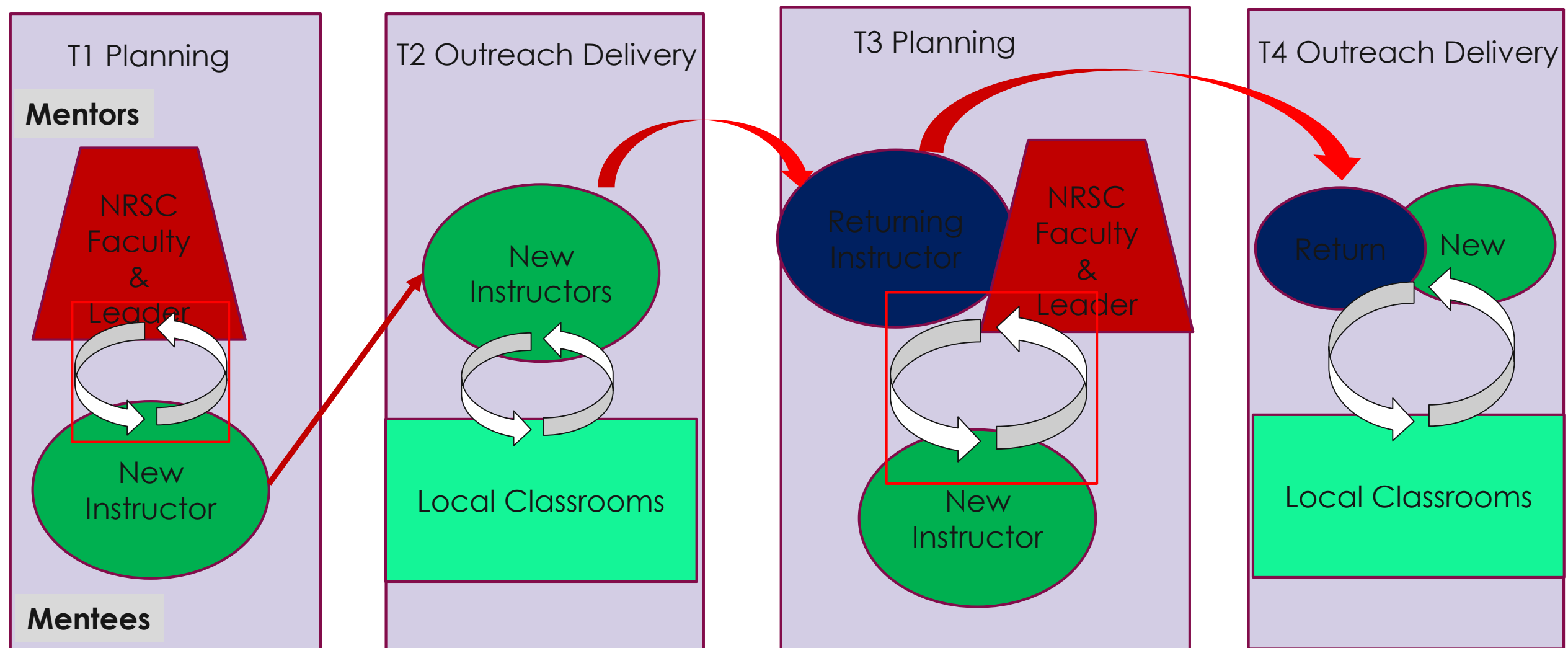
# Outreach Model:

## III layers of mentoring and role modeling



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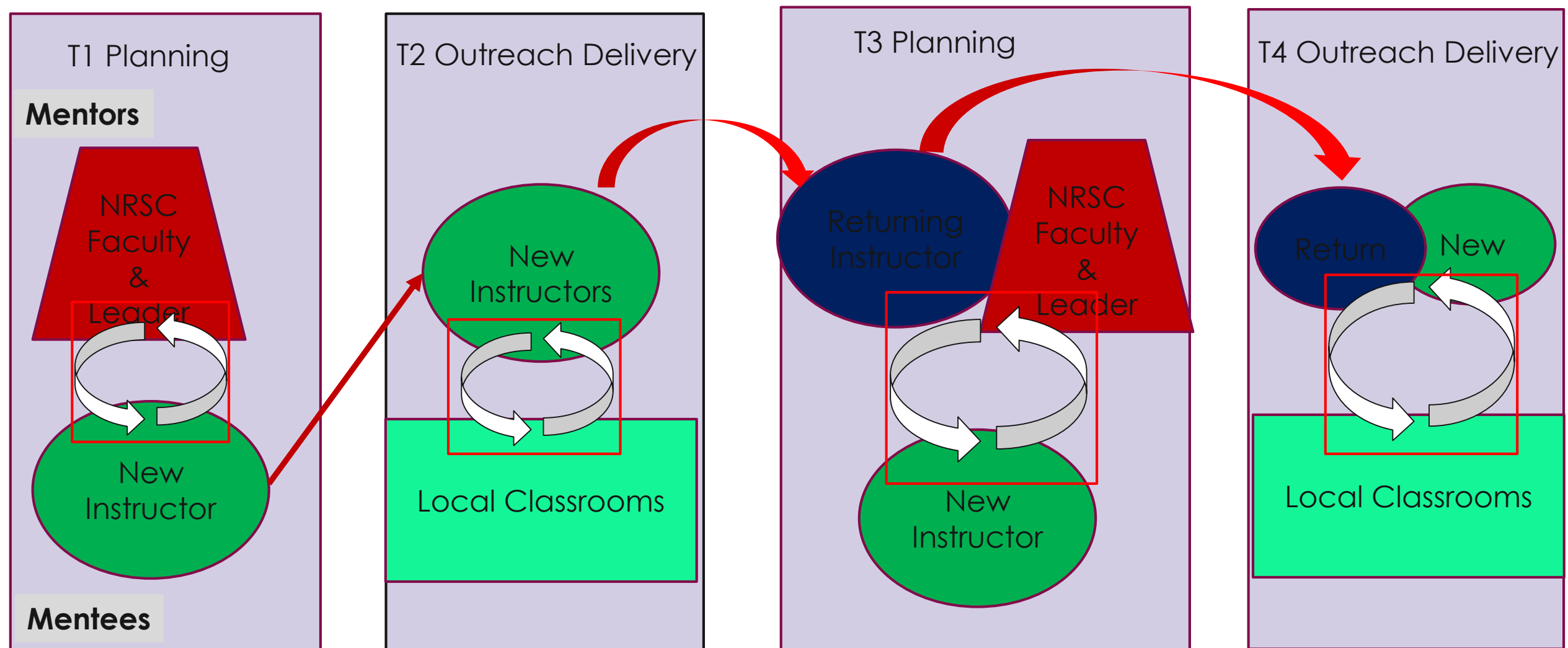
## III layers of mentoring and role modeling



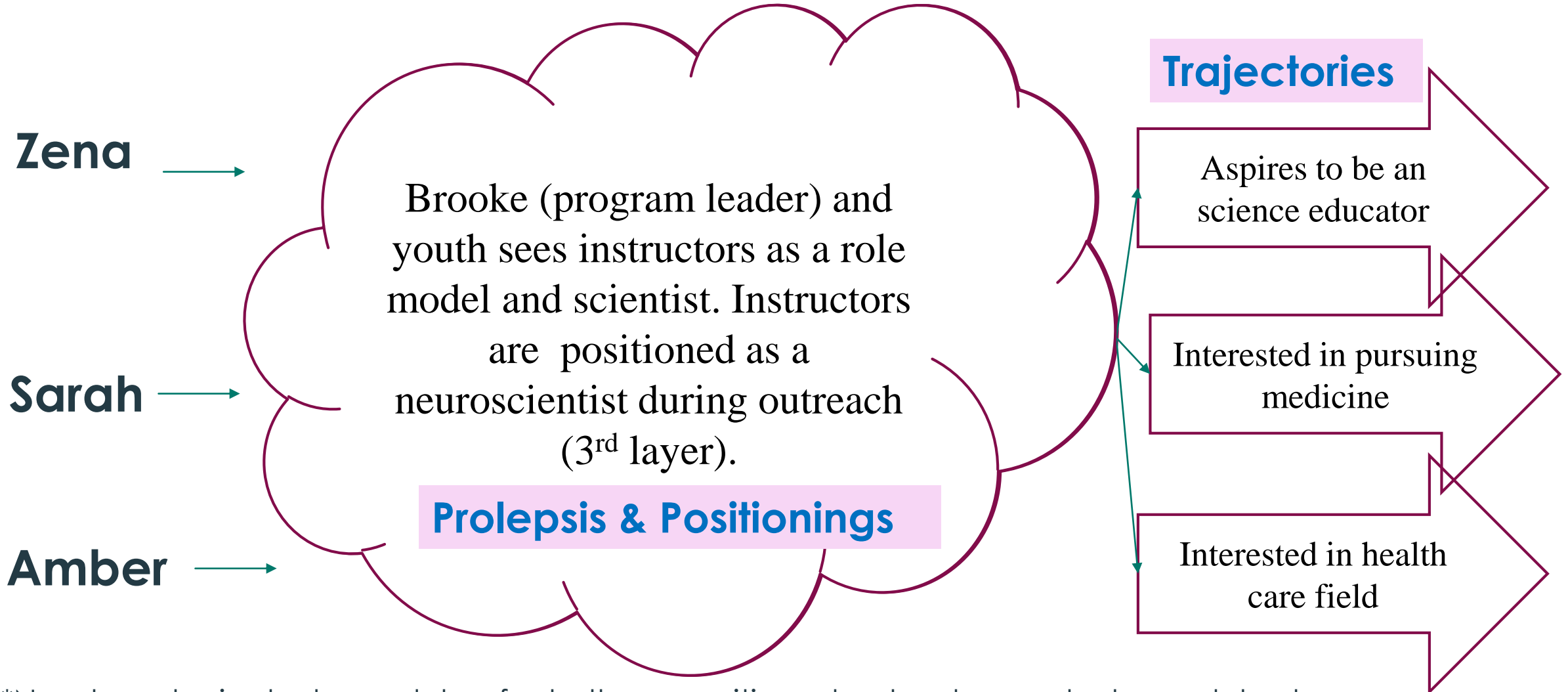


# Outreach Model:

## III layers of mentoring and role modeling

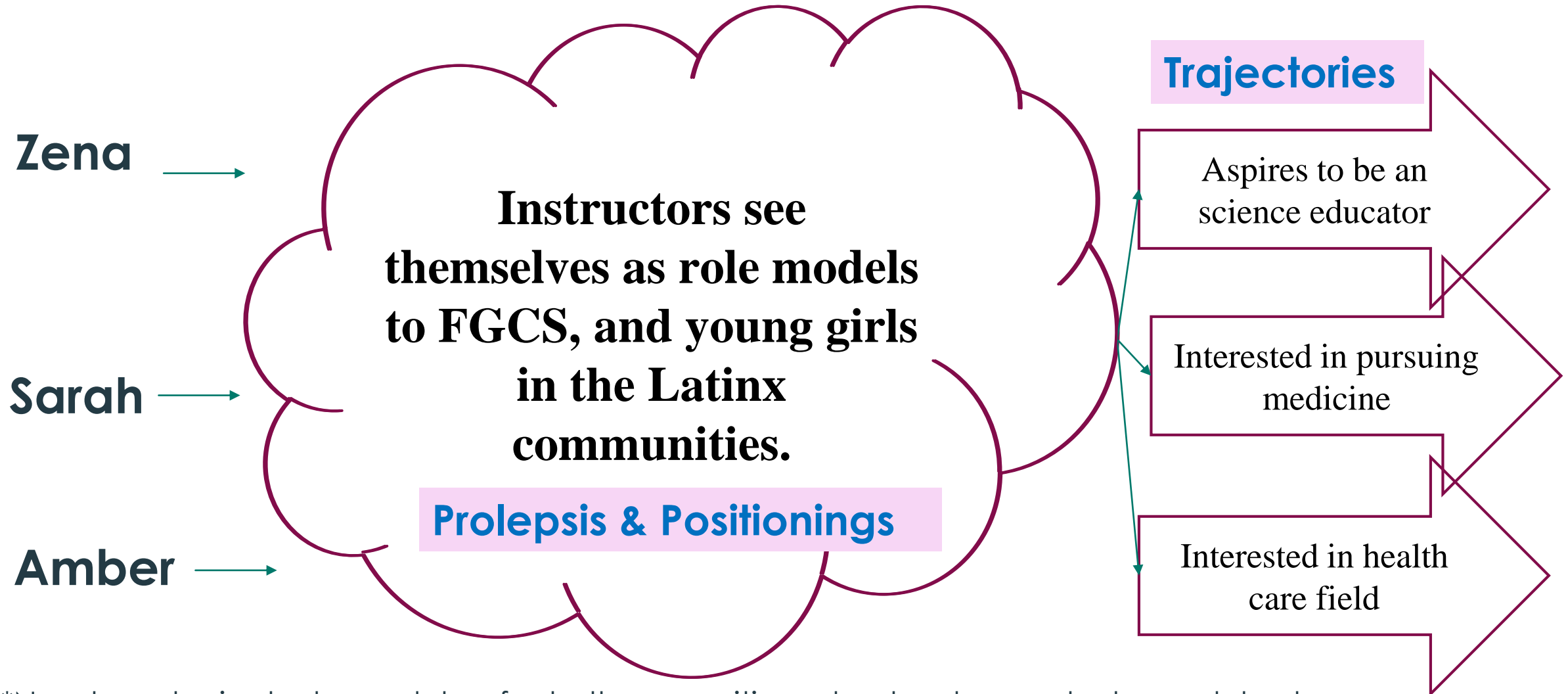


# Development of nonstereotypical role models\*<sup>18</sup>



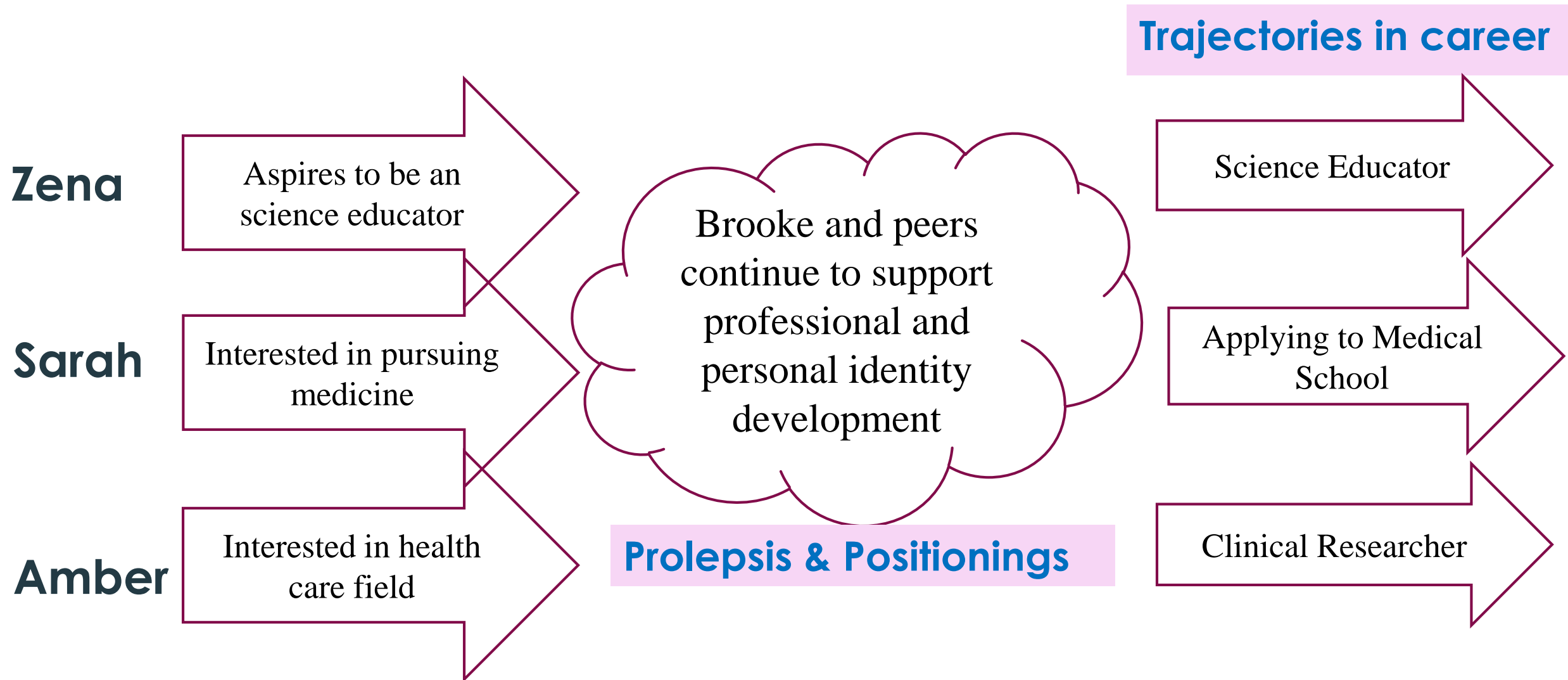
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# Development of nonstereotypical role models\*<sup>19</sup>




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# Development of nonstereotypical role models 20





# SOME EVIDENCE FROM CASES



# Participants POSITIONED as scientists



It was fun having real scientists in our classroom. I appreciated the diversity of the CU students visiting our classroom so our students could see someone that looked like them doing something pretty cool. It was also fun for my students to learn from young people (Post Lesson Teacher Survey Response, 4/6/2016).



# Participants see themselves in youth they serve<sup>23</sup> (Prolepsis)



Telling [the community] what I do... gives them a broader sense of what they can do (Zena Interview, April 2017).

# Participants see themselves in those they serve (Prolepsis)

...just knowing that a lot of them were Latina students and...I'm also Latina...I know that I personally when I finally see women of color who are out there...presenting or something like that I just instantly am like "Yes!" "Finally!" so...I don't know but yeah just cause they were so engaged and so respectful in the classroom that's why I felt [connected].... (Sarah Interview, August 2016).





# Neuroscience concepts and skills gained from outreach support academic success (“scene”)

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I...talked about how [neuroplasticity] is especially important for them to really appreciate and understand... I spoke about my experience as a first generation college student, how academia is... really challenging...[a]nd how often times you just wanna kinda say like... “Oh my gosh, I’m so dumb”, or “I’m so behind” but neuroplasticity gives you evidence to suggest that you can improve... then I just gave them examples of like studying habits...and how like once you do it neuroplasticity is in your favor...[NP] helps you become better at something that you wanna do (Sarah Interview, August 2016).



## Participants are supported through a group of peers and mentors (“scene”)



[I]n my opinion...we really down-sell the mentorship part of this program because there's a huge, through [Brooke], through the other students, there's a huge mentorship part...

...so I'm a first generation student. I came into college not knowing anything really...I feel lucky to even have gotten here however, once I got in here, and I tried so hard to get in here, I didn't know... what was next. And Brooke, through this mentorship, or through this internship has really mentored me into finding my path into pointing me into directions and exposing me to things...

(Amber, Interview, May, 2016).

## Continued mentorships support professional success

“...after the exercise position I worked as an exercise specialist...at a physical therapy clinic. I just didn’t like it. I didn’t feel challenged, I didn’t excel in it...I thought that I didn’t like research because of that bench work I was like almost turned off to it and that’s why I’m really into a position that was only working in a clinic. So I was working 100 percent of the time with patients. And then that’s when [Brooke’s] like you should really consider looking back into research but on the clinical sides of things and that’s how I found this position” (Amber, Follow-up Interview, October, 5, 2018).

[Brooke] helped me get the position at the study when I was previously a professional research assistant and she’s the one who told me about that opportunity and that’s how I got that. And she helped me out with a whole lot of other things too...It’s kind of going towards how much her mentorship has impacted my life. I believe she’s like my angel honestly like she’s just been the most important mentor I’ve ever had in my life, I’ll go that far” (Sarah, Follow-up Interview, October 15, 2018).

## Barriers (“scene”)

- Financial: program funding and sustainability.
- Findings from this study have informed design of a new internship program for undergraduates to develop skills as they support university clinical neuroscience research
- Lack of diverse role models in leadership positions
- Navigating institutional spaces of higher education and STEM workforce

# Concluding Remarks

- Diverse mentorships play a major role in student retention and success in STEM
- Participation in outreach mediate how undergraduates encounter and become mentors and role models
  - dispelling stereotypes of who can participate in science
- University and science learning spaces need to incorporate models of diverse mentoring and role modeling

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Questions & Feedback

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