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Initial Growth of Inclusive Knowledge and Leadership Practices by Science Education Teacher-Leaders

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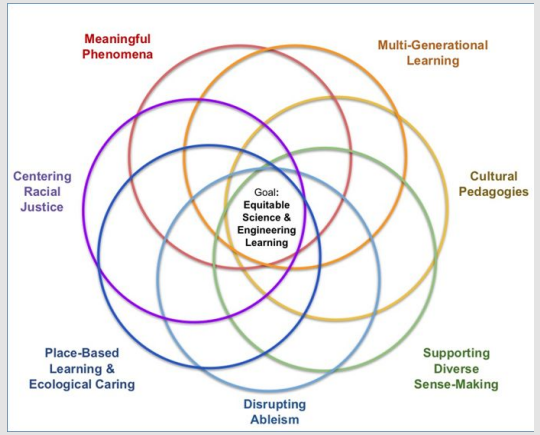
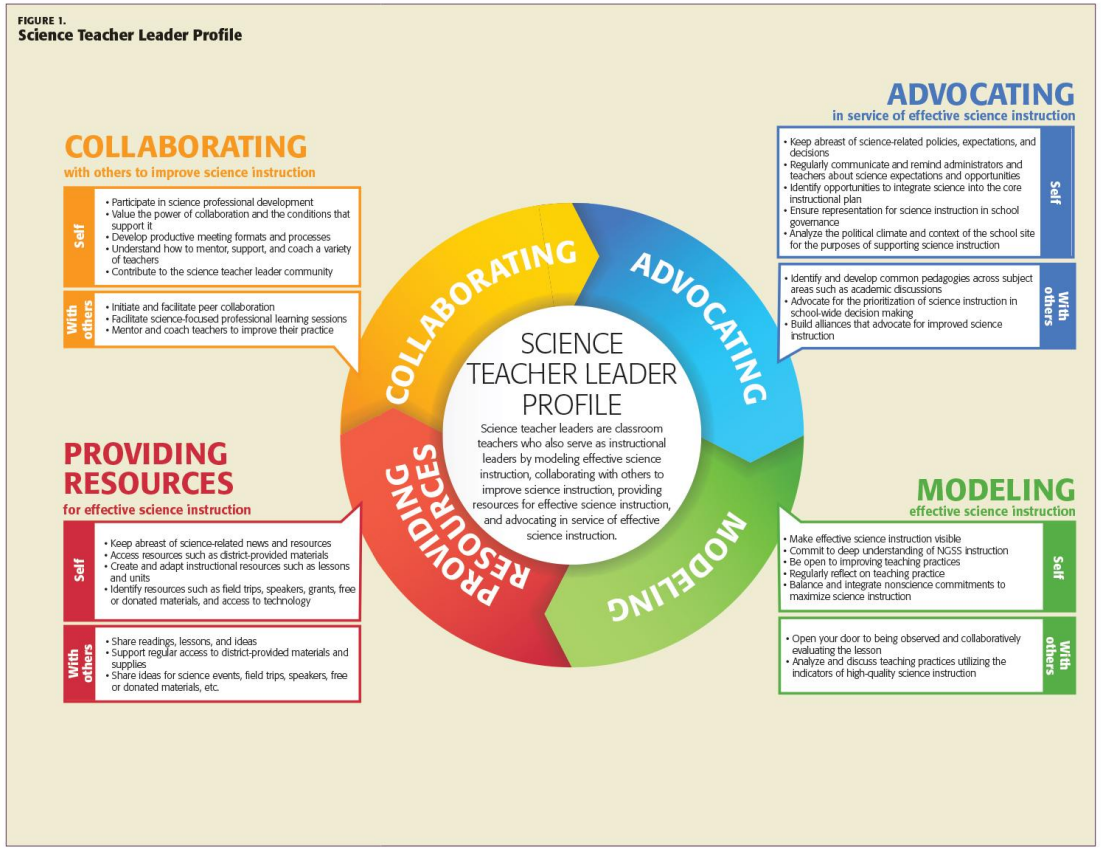


National Science Foundation
WHERE DISCOVERIES BEGIN

Introduction & Rationale for Study

- Science teachers are integral to the success of science education reform.
- Science education needs leaders from all parts of the field and system.
- However, science teachers have not been well-positioned for leadership.



Cheung, R., Reinhardt, T., Stone, E. & Little, J.W. (2018). Defining teacher leadership: A framework. *Phi Delta Kappan, 100* (3), 38-44.

Grant-funded Project & Study Focus

Study Focus:

Science teacher professional development as a result of a rigorous science education leadership program (66-credit hour Educational Specialist degree).

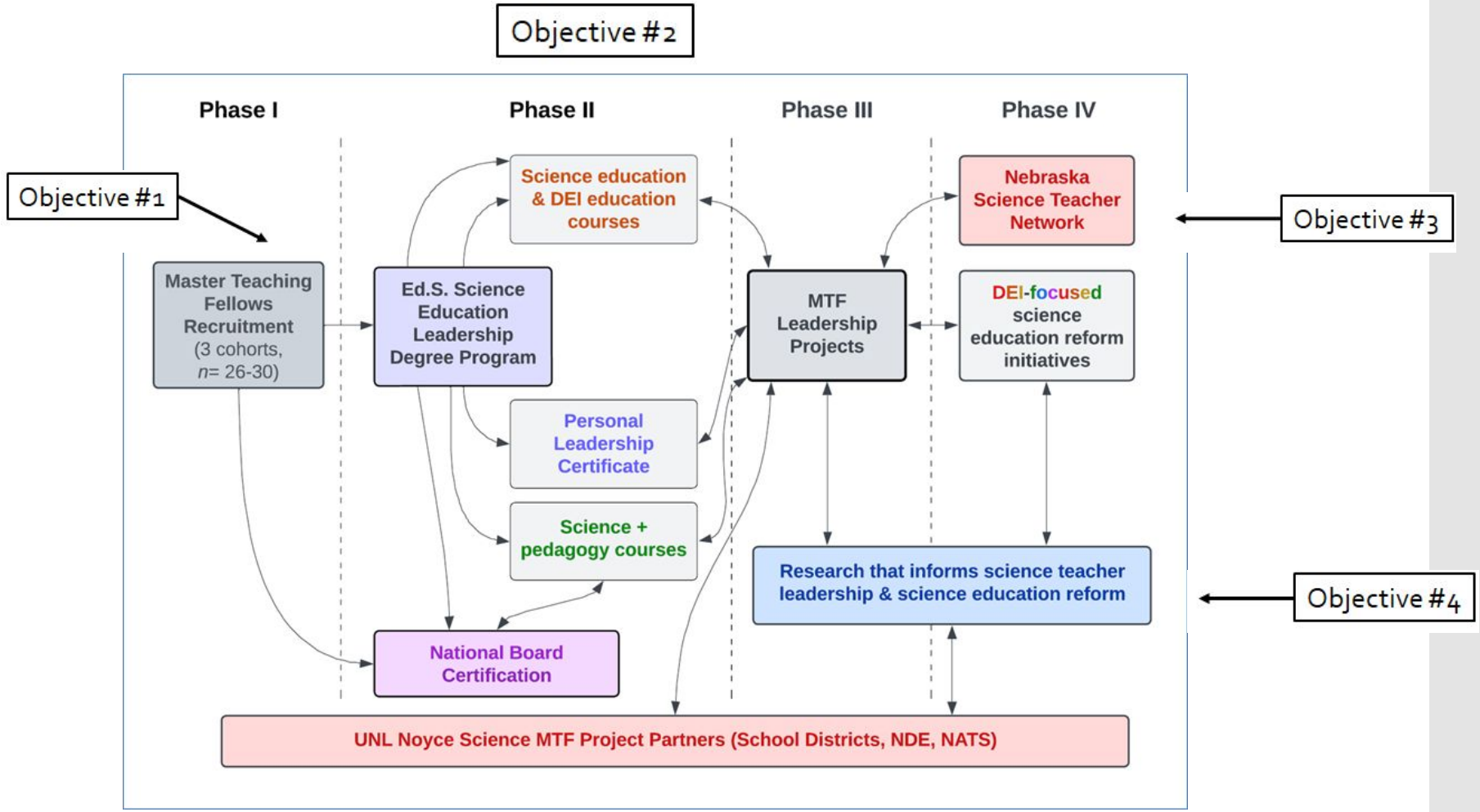
NSF Robert Noyce Track 3

UNL Noyce Science Teacher Leadership Development Project

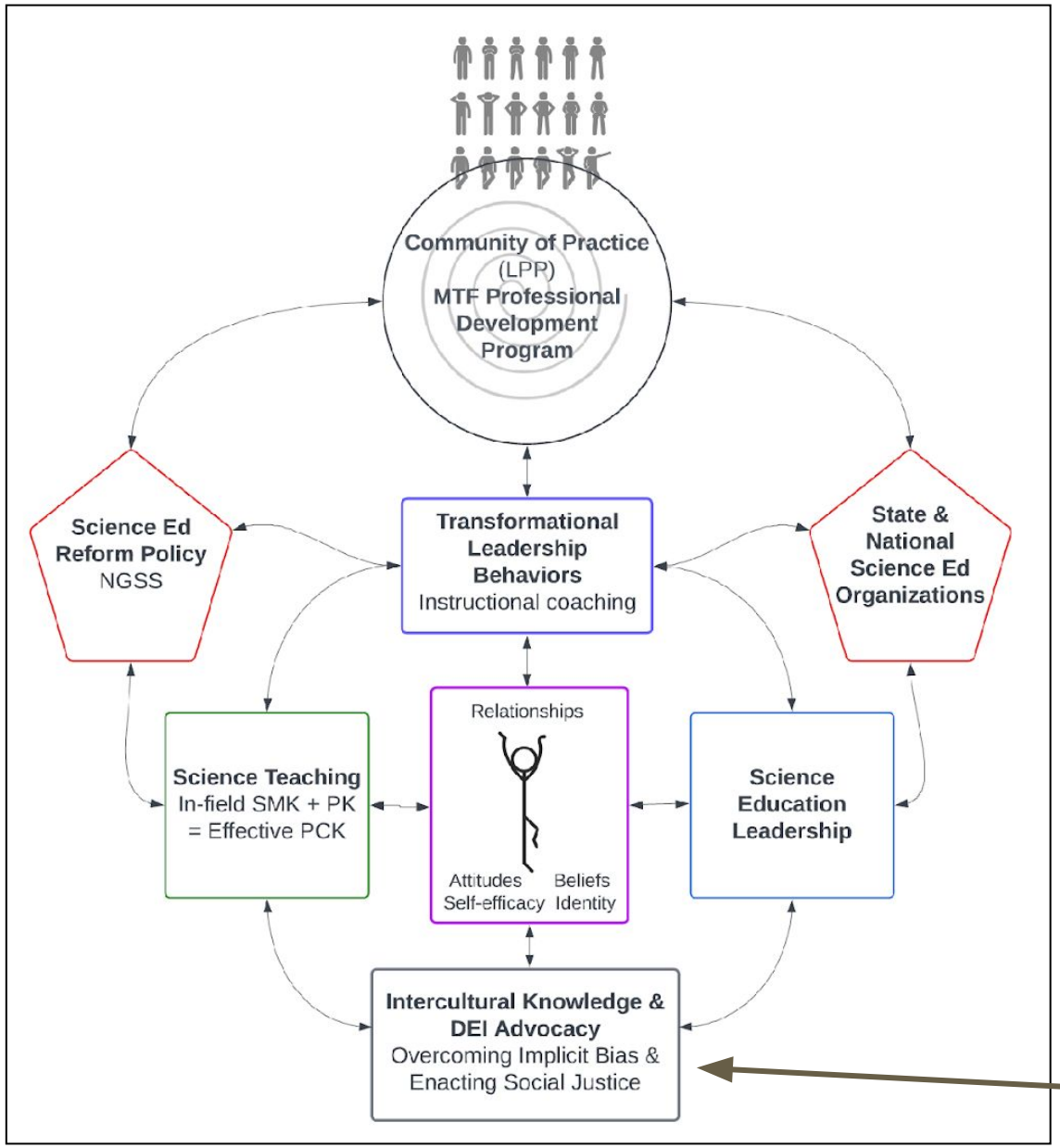
- Six-year NSF grant (July 2021 – June 2027)
  - **Retaining teachers.** 60% of grant is required to be dedicated to the Noyce MTF stipends ($11,000 each year for 5 years).
  - **Supporting diverse learners.** Noyce MTFs must concurrently complete 5 years of science teaching at high-need schools/districts.
- Remainder of grant is used to investigate science teacher leadership professional development and growth of professional networks.

Project Phases, Objectives, & Timeline

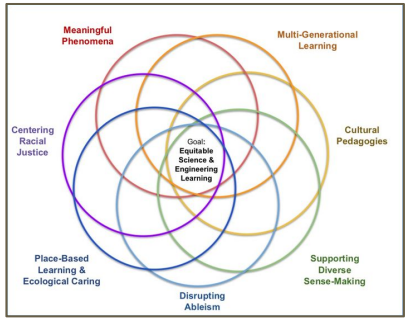
UNL NSF Noyce MTF Project Phases and Activities



Conceptual Framework



We developed this conceptual framework as a working model of science teacher leadership identity development.



ACESSE Framework for Equitable Science Learning

We have been using the ACESSE Framework to ground the overall design and specific aspects of the Educational Specialist degree program, coursework, and professional development.

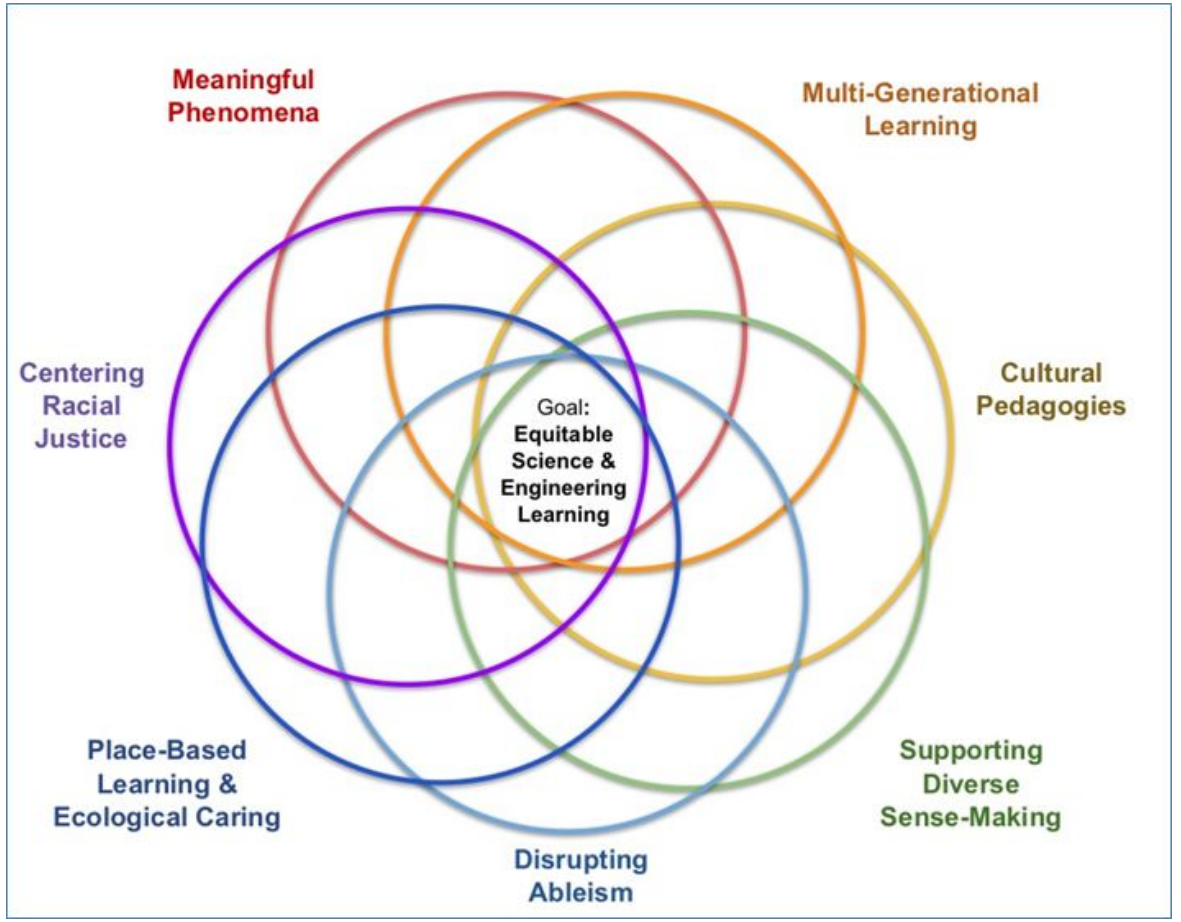


Figure 1. ACESSE Framework
https://sites.google.com/view/acesseproject/home

Literature Review

Leadership	Leaders with high cultural intelligence tend to exhibit transformational leadership behaviors by demonstrating adaptive responses in situations that require intercultural competence (Elenkov & Manev, 2009).
Teaching	Stronger in-field subject matter knowledge (SMK) leads to more inquiry-based science practices (Lewis et al., 2020).
Science Education Leadership	Science teachers who are department chairs and PD providers need a broad range of science SMK to be effective teacher mentors (Oehrtman et al., 2009).

Methodology: Approach, Research Question, & Participants

Methodological Approach:
Multi-method, descriptive statistics and longitudinal survey/interview

Study's Main Research Question:
What are science teachers' initial needs, capacity for learning, and group level change in cultural competence to be a teacher-leader?

Two Levels of Participants:

- School and teacher demographic information for 20 Noyce MTFs in first two cohorts.
- Noyce MTF Cohort 1 (n=11 teachers), to provide insights into the recruitment and professional development of these science teacher-leaders.

Methodology (con't): Data Sources & Analytic Methods

Data Sources:

1. *State-level teaching endorsements*
2. *Transcript analysis of all science coursework (credit hours)*
3. *School-level level demographics*
4. *Pre-program and post-Phase I (1.5-year mark) Intercultural Development Inventory® (IDI) survey*
5. *Inventory of prior and new teacher leadership experiences.*

Analytic Methods:

- *Descriptive statistics of teacher- and school-level demographics*
- *Coding of leadership activities*

Noyce MTFs' Science Teaching Experience & Certifications

Descriptive Statistics of Teacher- and School-level Characteristics

	Cohort 1	Cohort 2
Number of NSF Noyce MTFs	11	9
Years of Teaching Experience, M(SD)	16.7 (8.3)	11.1 (4.5)
Teaching Certification (%)		
Biology	54.5	22.2
Chemistry	27.3	22.2
Earth and Space Science	9.1	11.1
Physics	18.2	22.2
Science (General, "Broad Field")	54.6	44.4

MTFs are taking graduate courses to **expand their SMK**, especially in Earth and space science, chemistry, and physics.

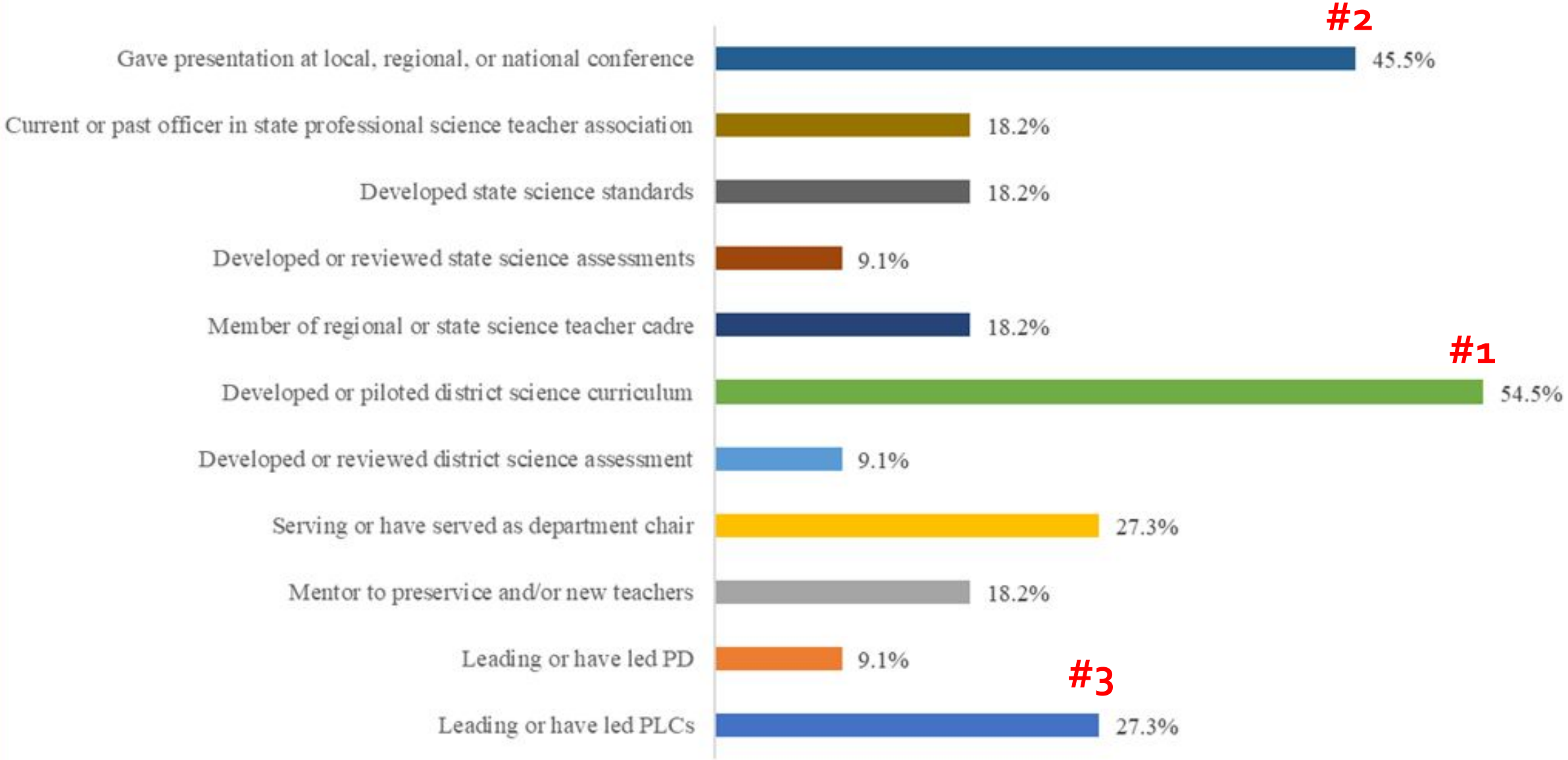
Teachers are often assigned to teach **multiple content areas**, which is a common challenge, especially in **rural areas**.

MTFs' School and District Demographics

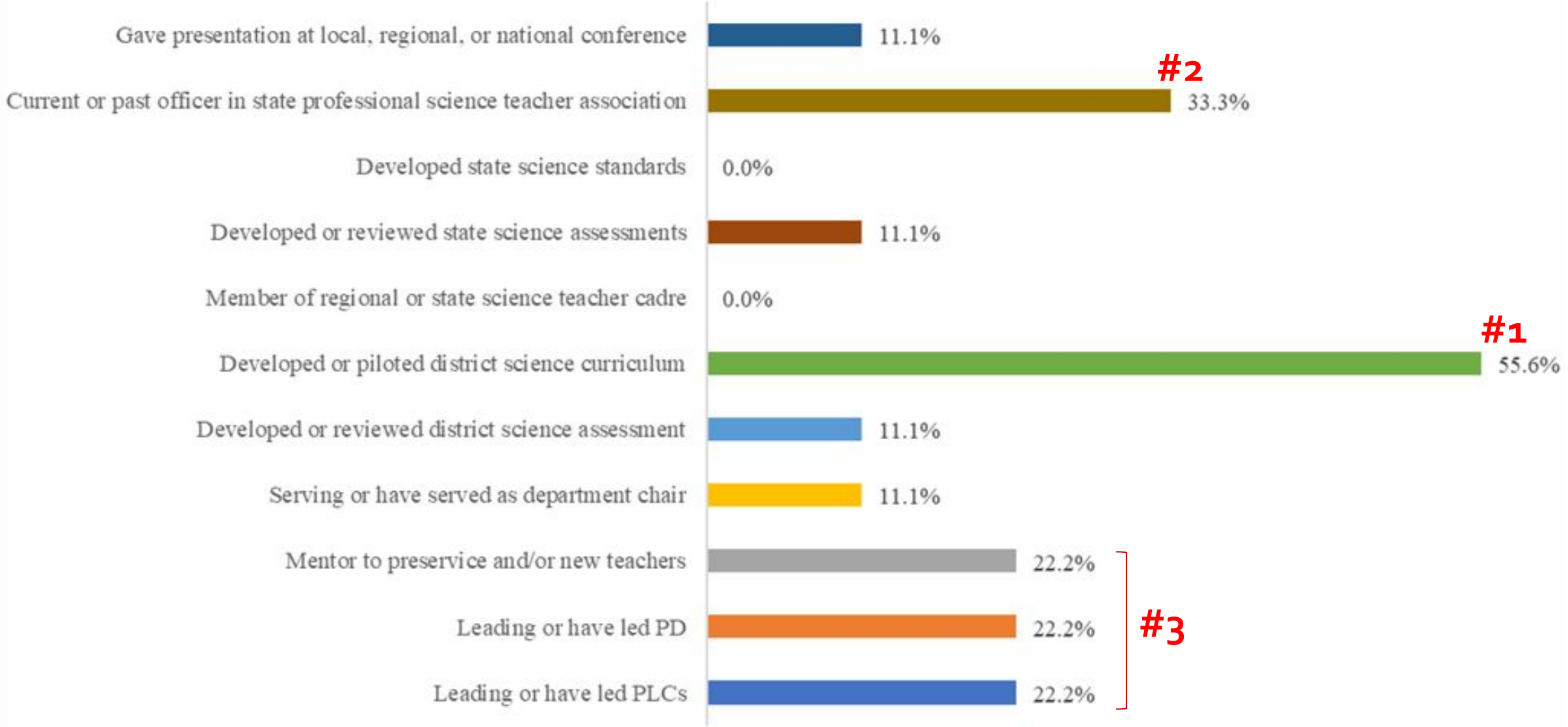
	Cohort 1	Cohort 2
School-level Student Demographics (%)		
FRL, M (SD)	44.0 (0.2)	56.8 (0.1)
BIPOC Students, M (SD)	41.1 (23.8)	52.9 (26.3)
ELL Students, M (SD)	5.8 (0.1)	8.0 (0.1)
District-level Student Demographics (%)		
FRL, M (SD)	44.9 (0.2)	58.2 (0.2)
BIPOC Students, M (SD)	39.4 (22.6)	51.1 (25.5)
ELL Students, M (SD)	9.2 (0.1)	15.9 (0.1)

MTFs' school districts range in size from **219** to **51,754** students.

UNL Noyce MTF Cohort 1
Science Education Leadership Portfolio To-Date
Inventoried: October 2021 Application Pre-Program - January 2023 at 1-year into MTF Program



UNL Noyce MTF Cohort 2
Science Education Leadership Portfolio To-Date
Inventoried: October 2022 Application Pre-Program

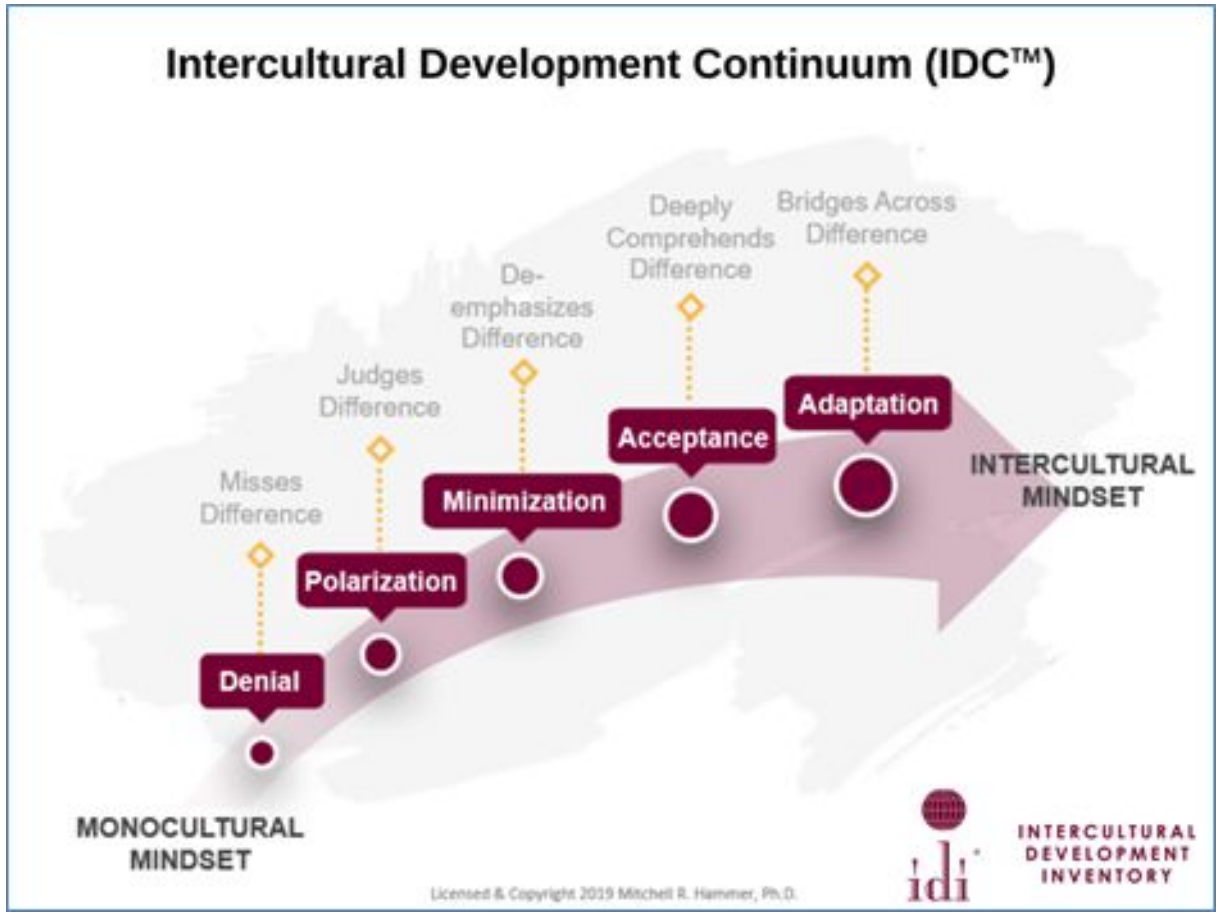


Summary of MTFs' Most Common Leadership Activities

To date, the **most common** teacher-leadership activities for both MTF cohorts include:

1. Developing and/or piloting a new science curriculum.
2. Attending a conference or giving a conference presentation.
3. Current/past officer in a state science teaching association.

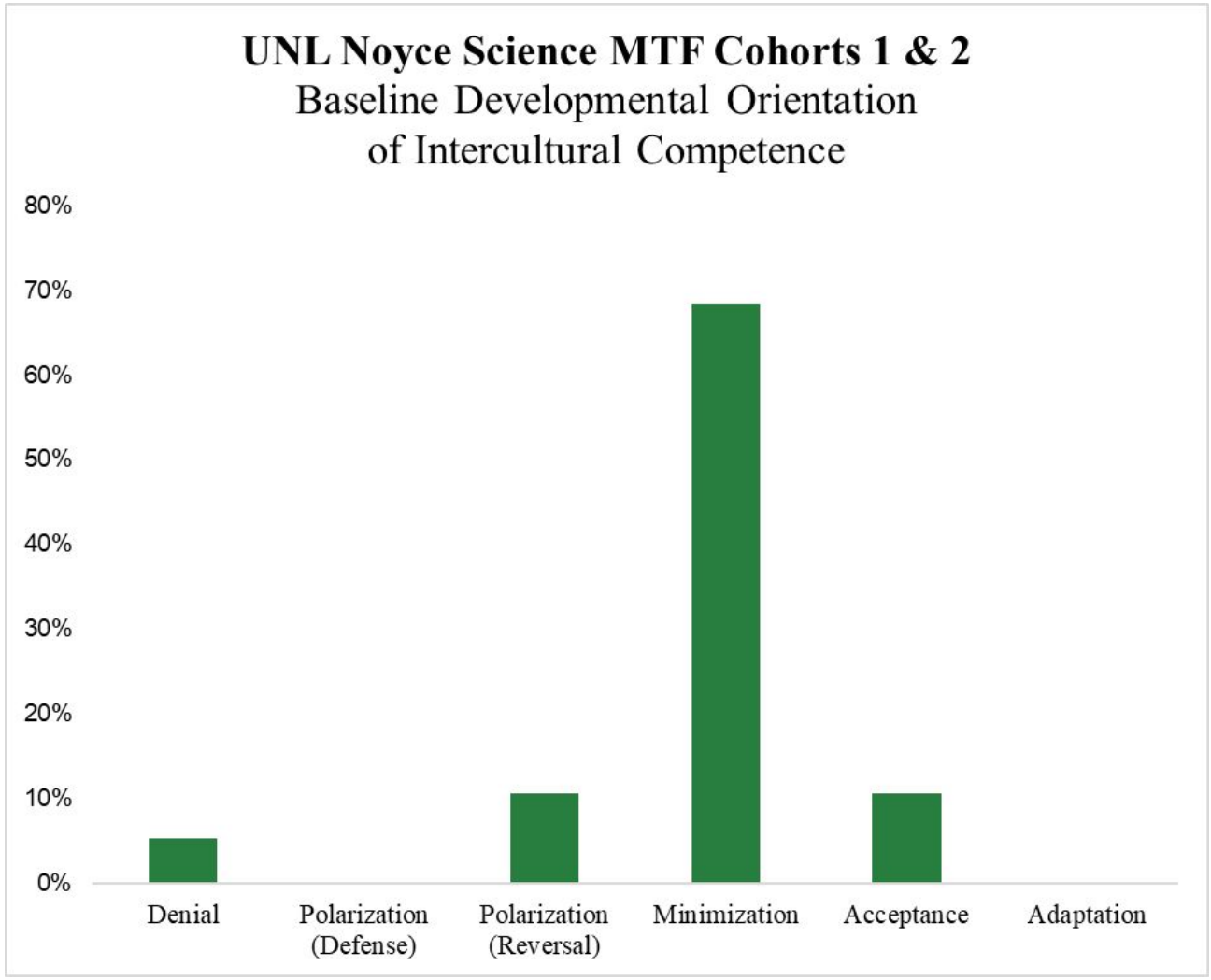
Methodology (con't): Research Instrument and Analytic Lens



Survey Data/Analysis using:

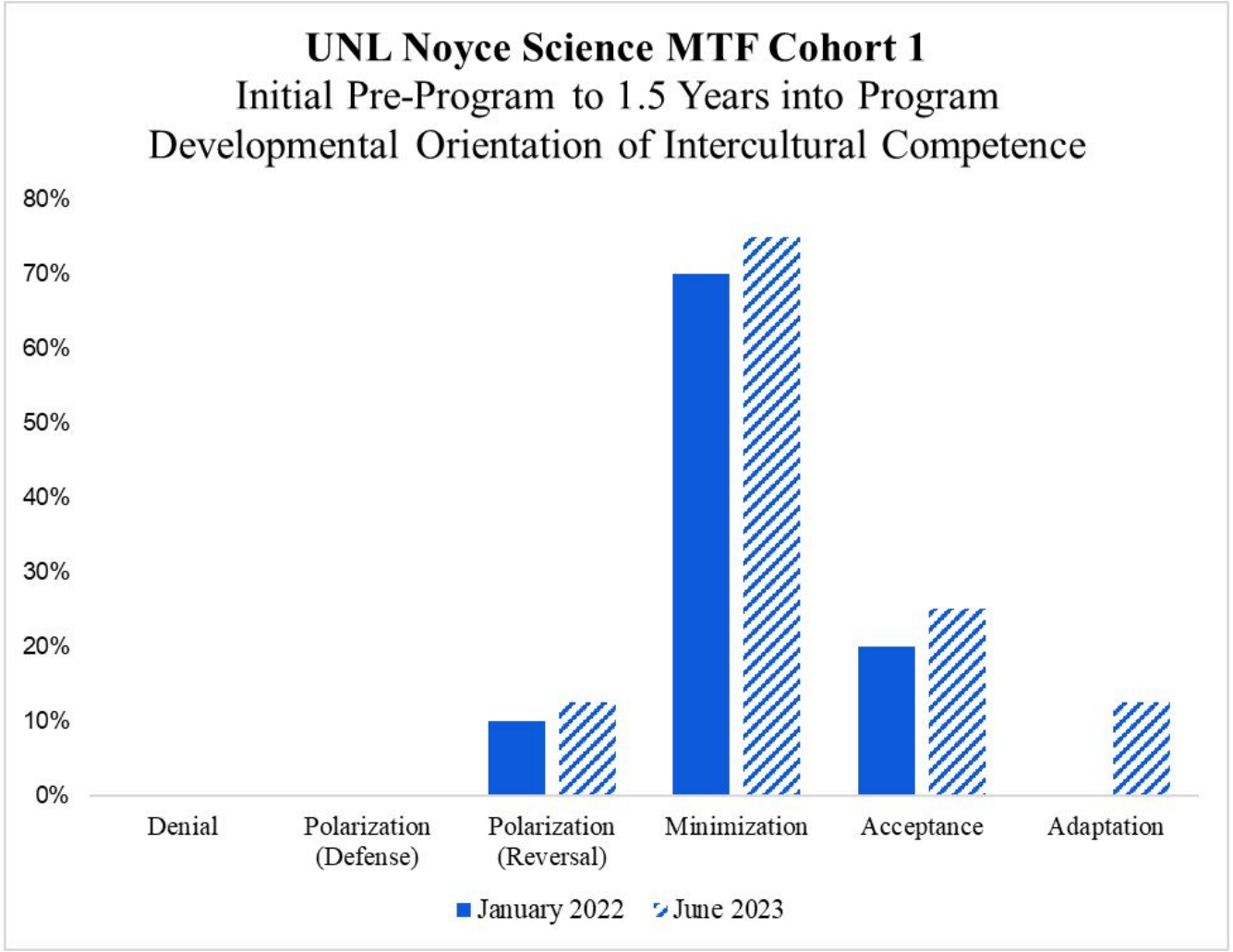
- *Intercultural Development Inventory® (IDI)*

Cohort 1 & 2 Baseline IDI Results



MTFs predominantly **interact across cultures** by focusing on similarities.

IDI Results (con't): MTF Cohort 1 Pre(T1)- Post (T2)

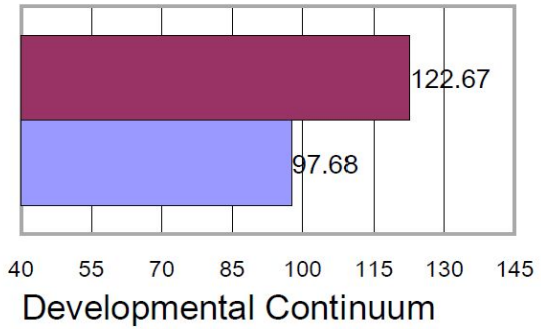


Cohort 1 MTFs are transitioning toward **ethnorelative** orientations.

IDI
Orientation Gap

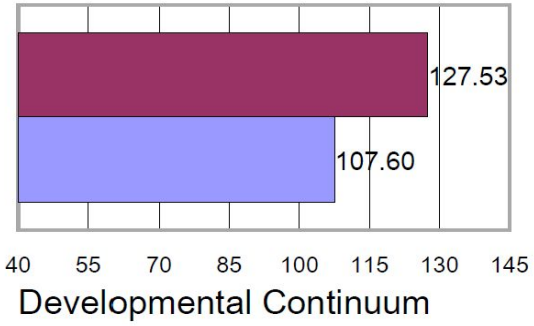
January 2022

Baseline OG : 24.99



June 2023

Post-Phase I OG : 19.93



- Narrowing of the gap between perceived and developmental orientation indicates MTFs have a **more accurate self-perception** of their intercultural competence.
- **June 2023:** Cohort 1 MTFs stated that they want more **intercultural experiences** embedded throughout the program.

Limitations

This study was conducted with a convenience sample and a small group of participants, who were mostly white (85%) and cisgender (100%), and thus,

Our findings are **transferable** to similar contexts rather than generalizable.

Recommendations & Implications

This project has allowed us to generate **empirically based recommendations** about supporting the development of science teacher-leaders, including:

1. the power of **close collaboration** among science, education, and leadership faculty members (co-PIs), and
2. **re-balancing program elements** so as not to inadvertently burn out teacher-participants.

Strong science education leadership requires **support to shift one's professional identity and priorities** through:

- rigorous professional development,
- access to opportunities, and
- individualized mentorship.

Conclusion & Future Research

1. As we continue this project, we will continue research focusing on an overarching question:

   How does the development of **science teacher-leaders** affect statewide science education reform?

2. We will also explore:
   - How MTFs' engagement in this program influences their intercultural competency; and
   - If there are any ripple effects in their local districts and professional networks.

Acknowledgements

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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