Know Thyself, STEM Teacher:
Autoethnography as a First Step to Compassionate STEM Teaching

I can't believe that activity didn't work! The students just sat there. I loved that
project when I was in HS! I've heard from other teachers that most students
don't care. Maybe that's the problem? Or maybe they just don't like me? Ugh.
--Preservice STEM Teacher

To teach is to be occasionally surprised, baffled, and frustrated by our students, our administrators, and even by our own teaching. How do we prepare new STEM teachers to respond with compassion and self-reflection to these experiences? We have found that *autoethnography*, a process of self-inquiry that reveals our often-hidden beliefs and assumptions about what good STEM teaching looks and feels like in the classroom, is a vital part of teacher preparation. Autoethnography catalyzes in novice (and veteran) STEM teachers a critical realization: others experience STEM learning differently than we do, and therefore need different STEM teaching than we imagine. The recognition that all students bring their own STEM identities to our classrooms makes possible compassionate and culturally congruent responses when our teaching inevitably falls short of our goals.

Autoethnography consists of knowing ourselves, unearthing artifacts from our own lives and experiences, searching for the critical incidents and storylines that make up our STEM identities. Some of the activities we engage our STEM teachers in include completing a STEM Teaching Personal Interview (see Fig 1, adapted from Kalmbach-Phillips & Carr, 2014), composing and sharing "I Am From" poems (see https://iamfromproject.com/), creating STEM identity timelines, and drawing visual images of "Good STEM Teacher." Analysis of these personal artifacts reveals sources of STEM identity, clarifying some of the "…ways in which science identity is fostered or thwarted by the context in which students experience science" (Kim & Sinatra, 2018).

We become the STEM teacher we needed when we were in school

What is "good," effective, STEM teaching? What makes us feel that we are "good" teachers? The way we answer this question comes from our own individual, internal, STEM teacher identity, an identity formed through family history, schooling, and other life experiences and events. Parker Palmer (2007) articulated this idea well:

"Teaching, like any truly human activity, emerges from one's inwardness, for
better or worse. As I teach, I project the condition of my soul onto my students,
my subject, and our way of being together. The entanglements I experience in
the classroom are often no more or less than the convolutions of my inner life"
(p. 1).

I bring my own STEM teacher identity to STEM teaching, for better or for worse. If I simply become the teacher I needed when I was in school, I will be less able to teach my real

students. I will remain surprised, baffled, and frustrated at their response (or lack of response) to my teaching. As Palmer wrote, "I will see them through a glass darkly, in the shadows of my unexamined life—and when I cannot see them clearly, I cannot teach them well" (p.1).

Developing a strong STEM teacher identity is essential to successfully supporting STEM identity in students (Galanti & Holincheck, 2022). Teaching while blind to our own STEM teacher identities risks excluding students from STEM who don't need the same STEM teacher we needed. We may act, unintentionally, as doormen at an exclusive "Club STEM," admitting only those who fit in with the crowd inside. Faced with the disappointment and even guilt of failing to bring "STEM to All" we may resort to blame---bad curriculum, bad school, bad students—or, tragically, bad teacher (us). In such a state, our choices shrink to finding a different school, perhaps one in which the students and community are more like us, or leaving teaching altogether.

Moving beyond blame and deficit-based STEM teaching and preparing for a compassionate practice of reflection and change demands that we reach outside of ourselves, beyond the STEM student we were, and the STEM teacher we needed. We use *autoethnography* in our STEM teacher preparation program to provide learning spaces for aspiring STEM teachers to explore their STEM identities. We apply autoethnography as a form of narrative research in which preservice STEM teachers systematically analyze their personal experiences in the social and cultural context of STEM (Kim, 2016). STEM autoethnography supports new teachers to re-construct and examine their own STEM identity development, supporting the critical teacher skill of authentically joining students to create a compassionate, culturally congruent space in which students may more fully develop their own STEM identities (Quigley, 2011; Stewart, 2022, Carr, 2024).

I don't get it. Why aren't my students doing the homework?

It is common for even veteran teachers to be surprised, baffled, and frustrated by their students. Aspiring teachers are especially at risk of blaming their students ("they aren't motivated"), the curriculum ("this doesn't work"), or themselves ("I failed"). We have long drawn on the work of Costa (1995) to help our aspiring STEM teachers reframe, in very simplified terms, the STEM identities of their students. This re-interpretation is a first step to finding more compassionate and useful ideas and language with which to respond to common frustrations. In studying the identities of high school science students, Costa asked her subjects the question, "why are you here in this science class? What are you in school in general?" Costa generated descriptive categories based on the responses (we include three of Costa's five categories here, as described by Aitkenhead (2001):

1. *Potential Scientists*, whose transitions are smooth because the culture of family and friends is congruent with the cultures of both school and science.
2. *Other Smart Kids*, whose transitions are manageable because the culture of family and friends is congruent with the culture of school, but inconsistent with the culture of science.

3. *"I Don't Know" Students*, whose transitions tend to be hazardous because the cultures of family and friends are inconsistent with the cultures of both school and science.

Costa's categories do not attempt to understand the nuanced, complex, and intersectional STEM and school identities of students. Still, we use them with care to help aspiring STEM teachers begin to re-frame, in non-blaming terms, the inevitable disappointments they experience in their early clinical teaching work. We find that most often, new STEM teachers identify as either Potential Scientists, or Other Smart Kids, while most high school students in introductory science classes identify as "I Don't Know" students. Realizing this is a critical juncture in STEM teacher development, which we anticipate. We use autoethnography to help new teachers reconsider, using social and cultural lenses, how their students relate to the experiences of STEM and school differently than they did, and avoid falling into harmful, negative discourses when interpreting their students. By better knowing themselves, teachers are more prepared to consider the STEM identities of their students, and to reimagine school science to create more compassionate, congruent school STEM experiences.

I didn't think the students would be such people!

The autoethnographic work of our preservice teachers often reveals powerful stories of "Potential Scientist" identities starting early in life, building a strong congruence with school science. Other stories tell of "Other Smart Kids," whose identities were congruent with the culture schooling (good test scores and grades), only later becoming congruent with (sometimes in adulthood) STEM, often through the "invitation" of a critical STEM mentor (see Aitkenhead, 2001). We guide our preservice teachers to recognize that many or even the majority of their students experience STEM as "I Don't Know" students, whose identities are inconsistent with both STEM, and possibly school in general. This re-framing allows for new possibilities. The door becomes open to an asset-based discussion of the stories of students, the lived knowledge they bring to the STEM classroom, and the possibilities for engaging those assets. We invite preservice teachers to apply the construct of *neoindigeneity*, as used by Christopher Emdin, as the starting point for understanding STEM identity development (Emdin, 2016). We agree with Emdin, who asserts that, "For teachers to acknowledge that the ways they perceive, group, and diagnose students has dramatic effect on student outcomes, moves them toward reconciling the cultural differences they have with students, a significant step toward changing the way educators engage with urban youth of color" (p. 10). Autoethnographic work is the prerequisite first step toward acknowledging and making visible the ways we think about students, and creates the foundation for building cultural congruence.

What Keeps STEM Teachers Going?

Autoethnography helps our aspiring STEM teachers understand that "developing a STEM identity is a complex, multi-layered phenomenon" (Kim and Sinatra, 2018), and that a critical task of becoming a STEM teacher is to understand their STEM identity through cultural lenses. We are currently engaged with groups of early-mid career teachers in a year-long

autoethnographic project designed to help them identify, and learn to tell as stories, critical incidents and seasons that have proven vital to energizing their teaching journeys (NSF #2150955). We hope that this storytelling work will make more available the deep resources of strength that our teacher participants possess, and help them keep going into mature careers.

References

Aikenhead, G.S. (2001) Students' ease in crossing cultural borders into school science. *Science Education 85, pp. 180-188. https://doi.org/10.1002/1098-237X(200103)85:2<180::AID-SCE50>3.0.CO;2-1*

Carr, K. (2024). *What keeps STEM teachers going? Engaging Noyce Scholars and TF/MTFs in Autoethnography to Better Understand and Support Success and Retention.* Lighting talk presented at the AAAS Noyce Summit, July 17, 2024, Washington, D.C.

Costa, V. B. (1995). When science is "another world": Relationships between worlds of family, friends, school, and science. *Science Education, 79,* 313–333*.*

Emdin, C. (2016). *For white folks who teach in the hood-- and the rest of y'all too: reality pedagogy and urban education.* Boston, Massachusetts, Beacon Press.

Galanti, T.M., Holincheck, N. (2022). Beyond content and curriculum in elementary classrooms: conceptualizing the cultivation of integrated STEM teacher identity. *International Journal of STEM Education 9*, 43. https://doi.org/10.1186/s40594-022-00358-8

Kim, A.Y., Sinatra, G.M. (2018) Science identity development: an interactionist approach. *International Journal of STEM Education 5,* 51. https://doi.org/10.1186/s40594-018-0149-9

Kim, J. (2016). *Understanding narrative inquiry*. SAGE Publications, Inc., https://doi.org/10.4135/9781071802861

Palmer, P. J. (2007) *The Courage to Teach: Exploring the Inner Landscape of a Teacher's Life*. Hoboken, New Jersey, Jossey-Bass.

Phillips, D.K. & Carr, K. (2013). *Becoming a teacher through action research: Process, context, and self-study (3rd Ed).* New York, Routledge.

Quigley, C. (2011) Pushing the boundaries of cultural congruence pedagogy in science education towards a third space. *Cultural Studies of Science Education 6,* 549–557. https://doi.org/10.1007/s11422-011-9335-5

Prier, D.G. (2021). *Perseverance of Black Males in the 21st Century STEM Classroom: An Autoethnography of a Black Male STEM Teacher*. Doctoral dissertation, Texas Tech University. https://hdl.handle.net/2346/87555

Stewart, C. O. (2022). STEM Identities: A Communication Theory of Identity Approach. *Journal of Language and Social Psychology, 41*(2), 148-170. https://doi.org/10.1177/0261927X211030674