Science teachers learn to be policy advocates

John Metzler (foreground) and Brian Kays (background), high school physics teachers and AAPT/AIP Master Teacher Policy Fellows, converse with staff at the National Academies of Sciences, Engineering, and Medicine about the role of evidence-based policies to advance science education. Used with permission.

BY REBECCA VIEYRA, TREY SMITH, AND REBECCA HITE

The AAPT/AIP Master Teacher Policy Leader Fellowship is a one-year fellowship that aims to build teachers' policy knowledge, skills, and dispositions to act as change agents in science education policy spaces.

Funded by the American Association of Physics Teachers and the American Institution of Physics, the fellowship is composed of a cohort of 11 teachers in nine self-selected state-level teams who came together from across the country for a weeklong summit in Washington, D.C.

During this summit, teachers developed action plans to improve equity in science education — from petitioning state legislatures to allocate funding for science teachers' professional learning, to enlisting science teaching societies to promote evidence-based pedagogies to help girls and young women feel more welcome in science classrooms.

Amy and her colleague Catherine, both elementary science specialists from a rural region of the Midwest, applied as a team to the fellowship to explore the underemphasis on elementary science education in their state. (Teachers' names are pseudonyms in accordance with requirements of our project.)

They knew from their professional experiences and research that elementary teachers are often less comfortable teaching science than other subjects (Banilower et al., 2013). Further, the No Child Left Behind reauthorization had influenced schools

Jennifer Wise (second from right) leads fellows on a tour of the U.S. Capitol. From left: John Metzler, Amanda Whitehurst, Andrew Edmondson, Katie Martino, Becky Bundy, Jennifer Wise, and Brian Kays.

2018-19 AAPT/AIP Master Teacher Policy Fellows at the U.S. Department of Education. From left: Becky Bundy, Andrew Edmondson, Katie Martino, John Metzler, Julie Dahl, Amanda Whitehurst, Brian Kays, Jeff Hengesbach, Seth Guiñals Kupperman, Matthew Peterie, and Nichole Spencer.

to replace instructional time for science with literacy and math, precipitating a drop in science scores on internationally benchmarked assessments (Gonzales et al., 2009).

Yet they knew that science provides meaningful contexts for math and literacy learning (NRC, 2014b) and that early exposure to quality science education lays an equitable foundation for success in later science courses and careers (NRC, 2007; Saçkes et al., 2010). Armed with their professional experiences and research, Amy and Catherine planned to rally others in their region to address these issues to increase the amount of classroom time devoted to science.

Amy and Catherine returned to the fellowship for a second year to meet with other fellows from across the U.S. and share data they had collected showing that elementary students had less than an hour of science instruction per week — fewer than 12 minutes per day. Their data were consistent with national estimates that elementary students study science for only 20 minutes each day (NCES, 2012) despite figures that suggest local elementary teachers routinely wanted to teach more science.

Surprise erupted in the room when Amy and Catherine said that many teachers believed state-level policies limited instructional time in science, even though no such formal policy exists. Their findings eventually led them on a campaign to meet not only with area school principals, but also to meet with their state science supervisor to petition for more explicit guidelines for increased classroom time devoted to science.

Amy and Catherine both learned from this fellowship that, from their vantage point as educators, they had perspectives worth sharing with policymakers and were capable of doing so. For the first time, they delved into the world of academic research, acquiring university institutional review board permissions for human subjects research to conduct wide-scale data collection from teachers on time dedicated to teaching science.

They arranged for community gatherings of parents and administrators to use survey data to petition for change at the local level and met with their state science supervisor to petition for change at the state level. They partnered with local professional teaching societies to bring in other fellowship participants from across the country to share with their peers how quality science education in elementary schools has lifelong impacts. In sum, they learned that small changes can have big impacts on even very complex systems.

TEACHERS AND POLICYMAKING

The AAPT/AIP Master Teacher Policy Leader Fellowship is a form of professional learning, though not a typical one. The locus of teachers' work is typically perceived as occurring in classrooms or school buildings, directly

oriented toward students and their learning.

However, this fellowship was founded on the idea that what happens in the classroom is inextricably linked to policies, particularly at local and state levels, that govern teachers' practices. Teacher participation in policymaking improves policy design, in part because teachers are able to anticipate consequences of policies (Sunderman et al., 2004) and facilitate smoother policy implementation (NASEM, 2017).

Yet teachers are often boxed out of formal education policy processes (Hite & Milbourne, 2018) unless these processes involve union negotiations. Unlike other professions in which policy knowledge and action are included in training (Heiman et al., 2016), policy is frequently excluded from teacher preparation and rarely discussed during professional learning (NRC, 2014a). Moreover, teachers are also discouraged from expressing their opinions on matters of policy or politics in their capacities as educators (Powell, 2016).

Organizations such as the National Network of State Teachers of the Year and Teach Plus have developed programming to support policy advocacy by classroom teachers. However, very little work has focused on specific disciplines or content areas. Similarly, as teachers unions focus on collective concerns, they may attend less to the discipline-specific needs of teachers.

Teachers engaged in discipline-specific policy advocacy traditionally rely on representatives of national organizations to craft messaging and coordinate meetings with policymakers (AAPT Physics Master Teacher Leader Task Force, 2017). This approach leaves limited opportunities for the wider community of practicing teachers to make their voices heard, particularly on issues of local importance.

Discipline-specific professional learning for teacher advocacy helps to not only empower more individuals who have more direct knowledge of classroom practice, but also attends to the needs of teachers that might be unique to their discipline or context, which includes the underrepresentation of women and people of color in most science fields or the need for highly specialized professional learning for teachers of science.

TO LEARN MORE

For information about AAPT/AIP Master Teacher Policy Fellowships, visit **aapt.org/K12/Aspiring_to_Lead.cfm.**

To change these patterns and encourage science teachers' involvement in policy, the AAPT/AIP Master Teacher Policy Leader Fellowship leveraged resources and experiences from D.C.-based professional organizations and a research team to support teachers to take on state-level issues.

DESIGNING THE FELLOWSHIP

In coordination with the American Association of Physics Teachers and the American Institution of Physics, and in collaboration with four other former science teachers experienced in policy and research, we developed a fellowship to address discipline-specific needs of teachers of physical science who desired to learn more about policy, connect with like-minded teachers, and facilitate meaningful change at local and state levels through advocacy.

Educators applied to this fellowship in self-selected teams by describing an issue of concern related to equity in K-12 physics education, which included topics as diverse as supporting the development of elementary teachers' science teaching self-efficacy and recruiting teachers in high-needs fields such as physics and engineering.

Our design team selected fellows in state-based teams from Arizona, California, Colorado, Illinois, Kansas, Michigan, New York, South Dakota, and Wyoming, with the intent to leverage peer support within a common state context. Catherine and Amy were among the first cohort of 11 fellows.

After attending the first summer workshop, the first cohort returned to mentor 11 new fellows during the following year's workshop. Two months before and 10 months after the workshop, fellows participated in monthly video conference calls.

The design team included education experts from the American Association of Physics Teachers, science and science education policy experts from the American Institution of Physics, and science teacher policy leaders who had previously participated in a similar policy-based fellowship, the Albert Einstein Distinguished Educator Fellowship (U.S. Department of Education, n.d.). We drew on resources from the Teach to Lead initiative (ASCD, n.d.), as well as research on problem-based learning to establish these guiding program principles:

- **Envision the self as advocate** to build self-efficacy for advocacy at local, state, or national levels;
- **Visualize the issue within a system** to support systemic understandings of teachers' interests and needs related to science education policy; and
- **Leverage system resources and building support** to address the problem through scaffolding, case management, and planning.

ACTIVITIES

Based on these principles, we designed five interlocking activities to help fellows address issues that they identified as important in their local contexts.

1. **Fellows collaboratively created written and visual representations of a problem and possible solutions.**

As part of their applications, teams of two to four teachers from the same state or pair of states described a problem and possible solutions in a one-page document. During

the summer workshop, each team constructed a system map in which they tried to account for possible causes and effects as well as stakeholders and resources at local, state, and federal levels.

They also iterated on a logic model that included a statement of the problem, goals, planned actions, outputs, and intended outcomes. One-pagers, system maps, and logic models allowed fellows to make their thinking visible, develop a shared language, and identify gaps or disagreements in their group's understanding about issues and possible solutions.

2. **Experts presented case studies and advice for engaging in policy spheres.**

We invited guests to present their local and state-level advocacy work in science education. These included Tamara Anderson, an educator and advocate who leads racial justice work in Philadelphia by building grassroots coalitions, and Mike Vargas, a high school physics teacher from Arizona who has helped to craft state legislation to recruit more certified physics teachers.

Additional experts discussed their organizations' roles in education policy. Experts came from multiple sectors, including federal agencies (e.g. U.S. Department of Education and National Science Foundation), national organizations (e.g. National Governors Association and National Association for Colleges of Teacher Education), and local-level organizations (e.g. union president and representatives from chambers of commerce).

Topics included statuses and histories of science education policies; roles of local, state, and federal agencies in science education policy; roles of research in policymaking; and effective communication strategies.

3. **Critical friends provided feedback on issue framing and proposed solutions.**

After each expert's presentation, fellows pitched their ideas and shared one-pagers detailing their selected issue and requests for support. Experts served as critical friends by aiding fellows in identifying relevant data, revising their messages, and connecting them with other possible supporters. Members of the fellowship design team also served as critical friends throughout the week.

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4. **Fellows had authentic opportunities to practice.**

In addition to the opportunities to practice describing their policy issue, fellows visited Capitol Hill to speak with staffers and members of Congress. Although fellows focused on state-level issues, congressional visits provided opportunities to prepare for and navigate meetings with state legislators and legislative staff. The day fellows spent on the Hill was highly effective, particularly in terms of supporting teachers' self-efficacy.

5. **Throughout, fellows engaged in reflection.**

They reflected on shifts in their thinking about and approaches to addressing the problems of policy that brought them to the fellowship. Throughout the year following the summit in D.C., fellows met virtually to set goals and reflect further on what they were doing, why, and what they were learning.

WHAT THEY LEARNED

Data from interviews, document analysis, and observations of both cohorts' interactions suggested strong alignment among the three program principles and activities, which helped fellows **envision the self as advocate.**

Fellows were able to advocate for change by viewing themselves differently, growing in confidence in their abilities to advocate, and engaging with policymakers. One educator, reflecting on the importance of sharing her message first with critical friends and later on the Hill, said, "I was very apprehensive coming into this fellowship. I did not feel my voice had much weight, nor did I have authority to be working on policy. Since being here, I have been given many tools to help build my confidence. I have been forced to be comfortable with being uncomfortable. After the Hill visits yesterday, I feel confident to bring our message back to our school, district, and state."

Fellows were likewise able to better **visualize the issue within a system,** as many described their policy issues as part of a larger sphere of interworking parts. This shift in fellows thinking about problems of policy became most apparent when they encountered obstacles in their policy projects.

One team arranged meetings with the governor and state legislators from opposing political parties to craft a bill that allocated $1 million in scholarship funds to allow current teachers not certified in STEM fields to acquire a certification in high-needs STEM fields. In less than 12 months, that team was able to maintain state interest on the topic, get the bill passed, have the funds appropriated in full, and dozens of eligible teachers apply for the funds.

As their knowledge of systems grew, they also realized they had more work to do — an important outcome in and of itself. After meeting with the state department of education that distributed the funds, the team realized that they had left out one critical element of their system view of the problem — colleges.

One fellow explained the shifting understanding of the team's perception of what needed to be in its system this way: "What I really learned is that all of the things that we didn't know going into this process, we have educated ourselves, and I think we get a better and better picture of the situation the further we go through this. There are so many moving pieces that we just didn't talk to the heads of the colleges before we started this process. Those sorts of things are just unknown unknowns."

In tandem with building self-efficacy and better understanding policy issues, fellows also focused on **building support and leveraging resources to address the issue** by creating logic models replete with a yearlong plan to tackle the issues. Some issues, particularly those relating to science teacher certification and preparation, must be addressed in legislative and regulatory spaces, while others, such as supporting underrepresented students in science, require changes that might better begin within communities.

For example, fellows from three states developed a nationwide program to support African American secondary physics teachers. Their purpose was to identify and appreciate their unique experience as underrepresented persons in physics, teaching, and amplify their ability to serve as role models as persons of color.

As another example, fellows from a rural state worked beyond boundaries of a single school district to engage in professional learning with teachers in their region using a partnership model with universities.

NEXT STEPS

To elevate the teaching profession, we must more formally empower teachers to participate in policy processes, leveraging their content-specific (e.g. science) and experiential (e.g. classroom-based) knowledge (Bundy et al., 2019; NRC, 2014a).

The fellowship evidences how principled professional programs could develop teachers' policy identities and knowledge so they can identify, explore, and act on policy-based issues within education. Ultimately, we believe such support should be woven throughout the teacher professional learning continuum, starting in teacher preparation programs and continuing professional learning.

With an intentional, career-building approach, teachers can develop policy awareness, understanding, and advocacy early so they may participate in policy throughout their careers. This can help elevate teacher professionalism, foster a new appreciation for teaching as a profession, and forge new pathways for teachers as bold leaders in policy spaces.

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