



2014 ANNUAL REPORT

IMPROVING MATH & SCIENCE
TEACHING, LEADING & LEARNING



KSTF

Knowles Science
Teaching Foundation

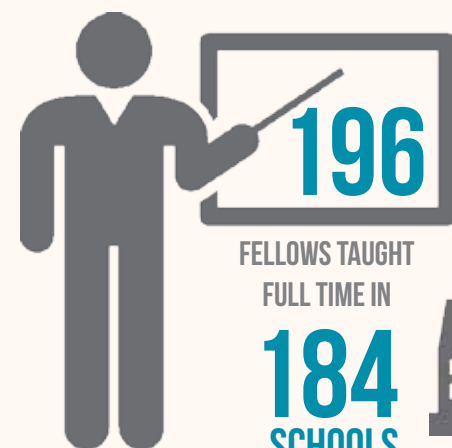
KNOWLES SCIENCE TEACHING FOUNDATION

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ABOUT KSTF

The Knowles Science Teaching Foundation (KSTF) was established by C. Harry and Janet H. Knowles in 1999 to increase the number of high quality high school science and mathematics teachers and ultimately, improve math and science education in the United States. KSTF operates three programs that build national capacity for improving STEM teaching, leading, and learning: Teaching Fellows, Senior Fellows, and Research & Evaluation. To date, KSTF has supported more than 250 Fellows in 42 states.

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IN 42 STATES AND IN THE DISTRICT
OF COLUMBIA IMPACTING MORE THAN

25,000

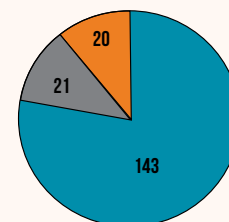
STUDENTS DURING THE

2013–2014

SCHOOL YEAR

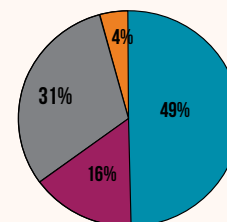
KSTF FELLOWS AT A GLANCE

SCHOOL TYPE AND LOCALE



■ PUBLIC
■ PRIVATE
■ CHARTER

TOTAL # OF SCHOOLS = 184



■ CITY
■ RURAL
■ SUBURB
■ TOWN

TOTAL # OF SCHOOLS = 166

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MESSAGE FROM THE EXECUTIVE DIRECTOR

Dear Friends of KSTF,

The fiscal year ending May 31, 2014 (FY14) was one of continued learning, transition and growth for the Knowles Science Teaching Foundation.

In 2002, when KSTF offered its first Teaching Fellowships, it was with the goal of increasing the number of high quality science (and later, mathematics) teachers in U.S. high schools. Now, over a decade later, 267 individuals are in or have completed the five-year Fellowship Program. Over 60% of those who have completed the program are still teaching high school math or science and over 70% are still involved in education in some way. We are clearly achieving our original goal of contributing to the pool of high-quality teachers in the country. However, our work over the past 12 years, including ongoing evaluation efforts and increasing attention to building teachers' leadership capacity, suggests that KSTF is doing something more profound and far-reaching than just adding to the pool of high-quality teachers. Through the joint

action of three programs (Teaching Fellows, Senior Fellows and Research & Evaluation), KSTF has developed the human and social capital needed to elevate and support teachers as primary agents of educational improvement.

With 12 years of the Teaching Fellows Program under our belts, and three years of the Senior Fellows Program, it's become clear to us that the two programs are and must continue to be mutually generative. The Teaching Fellows Program prepares and supports Fellows to be primary agents of educational improvement. Senior Fellows, having had the unique experience of the Fellowship and being part of the KSTF national network, collectively and individually continually redefine what it means to be a primary agent of educational improvement and what support teachers need to act in that capacity.

Our strategy for the future has two main prongs: continued investment in individual KSTF Fellows to support their development as leading teachers who will generate knowledge of and for the teaching profession, and investment in building and sustaining a national network that allows that knowledge to be widely critiqued, shared and built upon. This includes adding approximately 35 new Teaching Fellows every year; evaluating, refining and expanding support of our Senior Fellows; expanding the network of leading teachers to include and impact teachers who are not directly supported by KSTF; and supporting the network to drive educational improvement from the classroom up, rather than from the top down. This strategy challenges conventional notions of "scaling up," typically understood as replication and dissemination. Rather, KSTF seeks to scale its impact by sustaining, leveraging and amplifying the influence of networked leading teachers.

Thanks to contributions from our founders Harry and Janet Knowles, careful monitoring of program expenses and prudent management of our assets, our endowment has remained essentially unchanged since 2012. The financial statement that follows reflects our current solid financial position, but in order to meet the ambitious goals we've set for ourselves, we'll need to continue exploring new territory in terms of partnerships and additional funding sources.

I look forward to the exciting and challenging work that we've carved out for ourselves in the coming years.

Warmest regards,

Nicole M. Gillespie, PhD
Executive Director

KSTF CORNERSTONE

GOALS

The KSTF cornerstone goals describe who we are, what we do and why it matters. These cornerstones serve as the foundation for designing, evaluating and improving our programs to strengthen the teaching profession and improve science, technology, engineering and mathematics (STEM) education. Our cornerstone goals are as follows:

DEVELOP OUTSTANDING
TEACHERS

KSTF provides Fellows with opportunities to develop multiple dimensions of professional capacity for teaching.

BE A CATALYST FOR
TEACHER LEADERSHIP

KSTF supports Fellows to act as agents of improvement in and beyond their own classrooms.

GENERATE & SHARE
KNOWLEDGE

KSTF provides multiple opportunities for members of its community to systematically study their practice, and share and critique the knowledge gained from that process.

BUILD A NATIONWIDE
PROFESSIONAL COMMUNITY

KSTF creates conditions that allow Fellows to build strong professional relationships with members of the KSTF community, other teachers and the broader educational community.

DEVELOP OUTSTANDING TEACHERS

Through the Teaching Fellows Program, KSTF selects exceptionally talented individuals with the potential to develop into outstanding secondary science and mathematics teachers and leaders. During the five years of the Fellowship and beyond, KSTF provides its Fellows with a wide variety of opportunities to develop multiple dimensions of professional knowledge. The program also reinforces the importance of continually inquiring into and improving their teaching practice.

NATIONAL BOARD CERTIFICATION

Administered by the National Board of Professional Teaching Standards, National Board Certification is an advanced teaching credential developed for and by teachers. In December 2013, the following KSTF Fellows achieved National Board Certification:

- Laura Darnall, Goodpasture Christian School, Madison, Tenn.
- KD Davenport, Central High School, Philadelphia, Penn.
- Mark Hartman, Millbrook High School, Raleigh, N.C.
- Mandi Kraemer, Freedom High School, Orlando, Fla.
- Kate Markiewicz, Boston Latin School, Boston, Mass.
- Scott Murphy, St. Joseph's Preparatory School, Philadelphia, Penn.

KSTF GRANTS

Each year, KSTF Fellows are eligible to receive teaching materials and professional development grants. When requesting grant support, Fellows must submit a proposal outlining needs, goals, potential outcomes, cost justification and proposed methods for measuring impact. This process helps Fellows develop the skills and knowledge to successfully compete for resources and awards from other sources in the future. **In fiscal year 2014, KSTF awarded 57 teaching materials grants and 184 professional development grants to KSTF Fellows.** Below is a sampling of the work done in connection with grants awarded.

- 2010 Teaching Fellow Matthew McCollum and 2011 Teaching Fellow Mike Town were awarded a grant to purchase the materials needed for their 10th grade physics students

to build water rockets. Their students built upon their knowledge of principles of conservation of momentum, conservation of energy, force, and kinematics to complete an engineering task—the optimization of the performance of a water rocket.

- 2009 KSTF Teaching Fellow Mandy Colson was awarded a grant to cover the cost of attending a three-day workshop hosted by Expeditionary Learning, "Designing Learning Expeditions." Participation in the workshop provided Mandy and five colleagues with the opportunity to see expeditionary learning in action. Mandy used the knowledge she gained to help plan and facilitate professional development sessions for her colleagues.
- KSTF Senior Fellow Patricia Schaeffer was awarded a grant to cover the cost of attending the BSCS Professional Development Provider Institute. Through participation in the four-day institute, Patty was able to network and collaborate with other education professionals on deepening her understanding of the science and engineering practices in the Next Generation Science Standards (NGSS) and on developing professional development plans and resources that align with these practices. As a member of the KSTF Engineering Task Force (ETF), she leverages the knowledge she gained to help organize and plan professional development resources developed by the ETF.
- 2011 KSTF Teaching Fellow Jessica Scheimer was awarded a grant to cover the cost of participating in a two-day working session

with 2011 KSTF Teaching Fellow Mike Town and one of his colleagues. The three worked to develop a simplified skateboard design project. At Mike's school, the skateboard design project was slated for use with members of the skateboard club and summer school students. At Jessica's school, the project was slated for use with middle school boys, as part of two special sessions she was asked to teach during summer 2014. The trio also developed a project-based skateboard inquiry lab for use in their advanced physics classes. The lab focuses on the investigation of spring constant of skateboard decks, as more layers are added.

- 2013 KSTF Teaching Fellow Helen Harlan was awarded a grant to cover the costs associated with working as a counselor for two weeks at Empowering through Education Camp, which is located in Hinche, Haiti. In addition to developing and teaching an engineering curriculum, planning and organizing group activities and mentoring/monitoring the academic progress of three to four students, Helen got the opportunity to be immersed in the culture of Haiti. As a teacher of mainly Haitian English Language Learners in her school's Sheltered English Instruction (SEI) cluster, she found the experience especially useful, as it allowed her to study Haitian Creole with native speakers.

100% OF KSTF FELLOWS WHO APPLIED FOR NATIONAL BOARD CERTIFICATION IN THE 2012–2013 ASSESSMENT CYCLE ACHIEVED CERTIFICATION

NATIONAL BOARD CERTIFICATION IS AN ADVANCED TEACHING CREDENTIAL HELD BY SLIGHTLY MORE THAN 3% OF TEACHERS IN THE UNITED STATES. BY COMPARISON, 16% OF ELIGIBLE KSTF FELLOWS HAVE ACHIEVED NATIONAL BOARD CERTIFICATION SINCE 2008.

100%

KSTF IS COMMITTED
TO IMPROVING MATH
& SCIENCE TEACHING
& LEARNING IN THE
UNITED STATES.

61% OF KSTF FELLOWS "FACILITATED PROFESSIONAL
LEARNING FOR COLLEAGUES" DURING THE PAST TWO
ACADEMIC YEARS

86% OF KSTF FELLOWS REPORTED PARTICIPATING IN MORE
THAN 35 HOURS OF PROFESSIONAL DEVELOPMENT IN THE LAST
THREE YEARS, COMPARED TO 36% OF SCIENCE TEACHERS AND
32% OF MATHEMATICS TEACHERS NATIONALLY⁴

⁴SMITH, ADRIENNE A., JAFFRI, A. ZEHRRA & BANILOWER, ERIC R. (2014, MARCH). STANDING OUT IN THEIR FIELD: A COMPARISON OF THE KNOWLES SCIENCE TEACHING FOUNDATION FELLOWS TO TEACHERS NATIONALLY (REPORT NO. ER032014-02).

2014 TEACHING FELLOWS

Selected from a pool of more than 180 applicants, 32 exceptionally talented, early-career science and mathematics teachers were awarded Fellowships as part of KSTF’s 2014 Cohort of Teaching Fellows. Equipped with a great wealth of skills and experience that will benefit the teaching profession and students across the nation, the 2014 cohort includes two Returned Peace Corps Volunteers, three engineers, an aquatic entomologist, a scientific diver, a river guide, a wilderness firefighter and a veteran of the United States Army. Their Fellowships began on June 1, 2014 and will continue through the summer of 2019.



TJ ALCALA

TEACHING AT: Cistercian Preparatory School
LOCATION: Irving, Texas
HIGHLIGHT: Taught high school students in Uganda for seven weeks



ROSHAN ANGLIN

TEACHING AT: Washington Technology Magnet School
LOCATION: Saint Paul, Minnesota
HIGHLIGHT: Led activities and group discussions with girls in grades five through seven while working at a summer program for girls interested in mathematics



ERIKA BLAND

TEACHING AT: Menlo Atherton High School
LOCATION: Atherton, California
HIGHLIGHT: Discovered desire to have her own classroom while teaching marine science at the Marine Science Institute in Redwood City, Calif.



CARLY BROWN

TEACHING AT: Craftsbury Academy
LOCATION: Craftsbury, Vermont
HIGHLIGHT: Taught various science courses and life skills in Kenya as a Peace Corps Volunteer



VALENTINA BUMBU

TEACHING AT: Soldan International Studies High School
LOCATION: Saint Louis, Missouri
HIGHLIGHT: Discovered her passion for education through teaching assignments completed as part of her chemistry doctoral studies



NICHOLAS CHAN

TEACHING AT: San Francisco International High School
LOCATION: San Francisco, California
HIGHLIGHT: Facilitated workshops on HIV/AIDS prevention in Ecuador as a Peace Corps volunteer



ADAM CLINCH

TEACHING AT: Capital High School
LOCATION: Helena, Montana
HIGHLIGHT: Coauthored a paper that was published in the journal *Physics of Plasmas*



KATRINA MUIR CORNELL

TEACHING AT: Telluride High School
LOCATION: Telluride, Colorado
HIGHLIGHT: Worked in informal teaching/education roles—including teaching assistant, tutor, long-term substitute teacher, river guide and backpacking trip leader—for 10 years prior to earning her teaching credential



TIMOTHY ELLIS

TEACHING AT: Washburn Rural High School
LOCATION: Topeka, Kansas
HIGHLIGHT: Incorporates debate into his classroom as a science teacher and forensics coach



JOLIE GLASER

TEACHING AT: Green Valley High School
LOCATION: Henderson, Nevada
HIGHLIGHT: Conducted research with the Alaska SeaLife Center and the National Ocean Science Bowl



JOE COSSETTE

TEACHING AT: Minnetonka High School
LOCATION: Minnetonka, Minnesota
HIGHLIGHT: Served as teaching assistant for freshman leadership seminar alongside the president of Iowa State University



SARAH DIMARIA

TEACHING AT: Manor New Technology High School
LOCATION: Manor, Texas
HIGHLIGHT: Teaches an online, project-based astronomy class for high school students



MARGOT GOLDBERG

TEACHING AT: Pittsburgh University Preparatory School at Margaret Millions
LOCATION: Pittsburgh, PA
HIGHLIGHT: Uncovered passion for teaching while leading science demonstrations at institutions such as the Carnegie Science Center



LEROY GRAY

TEACHING AT: Science Leadership Academy at Beeber
LOCATION: Philadelphia, Pennsylvania
HIGHLIGHT: Developed physics curriculum at new, inquiry-driven, project-based school



JOHN HOLCOMB

TEACHING AT: UIC College Prep
LOCATION: Chicago, Illinois
HIGHLIGHT: Transitioned to teaching after working as a chemist at 3M



BRIAN HUSER

TEACHING AT: Lighthouse Community Charter School
LOCATION: Oakland, California
HIGHLIGHT: Worked as clinician in the Department of Mathematics and Statistics at Swarthmore College, a residential teaching assistant and private math tutor during his undergraduate studies



BRENDA MINJARES

TEACHING AT: Escondido High School
LOCATION: Escondido, California
HIGHLIGHT: Teaches people about infrared astronomy and its real-world applications as a Stratospheric Observatory for Infrared Astronomy (SOFIA) volunteer



MATTHEW NEAL

TEACHING AT: Fort Dorchester High School
LOCATION: North Charleston, South Carolina
HIGHLIGHT: Taught English and mathematics to eighth grade students in Shanghai for six weeks



KATRINA JONES

TEACHING AT: Richland High School
LOCATION: Richland, Washington
HIGHLIGHT: Investigated the healing process of sea anemones through genomic studies while earning a Master of Science in cell and developmental biology



LAUREN KLINE

TEACHING AT: Kenwood Academy High School
LOCATION: Chicago, Illinois
HIGHLIGHT: Conducted research on terrestrial and marine ecosystems just off the coast of Queensland, Australia



CHRIS O'BRIEN

TEACHING AT: Palma High School
LOCATION: Salinas, California
HIGHLIGHT: Helped develop a new method for molecular imaging during electron radiation therapy, while working as a research assistant in the radiation oncology department at Stanford University



JESSICA PERALTA

TEACHING AT: Oxford High School
LOCATION: Oxford, Mississippi
HIGHLIGHT: Worked to promote interest in STEM fields as a Graduate Research Fellow at the University of Mississippi's Center for Mathematics & Science Education.



SUSAN PIENTA

TEACHING AT: Dewitt Middle School
LOCATION: Ithaca, New York
HIGHLIGHT: Spent two years as a full-time AmeriCorps member—one year doing watershed management in California and another year doing salmon restoration in Maine



ERIC RASMUSSEN

TEACHING AT: Silver Creek High School
LOCATION: Longmont, Colorado
HIGHLIGHT: Taught general and marine biology to high school students who would be the first in their family to attend college as an Upward Bound instructor at the University of Colorado Boulder



CAROL STOLL

TEACHING AT: People's Preparatory Charter School
LOCATION: Newark, New Jersey
HIGHLIGHT: Performed ecological fieldwork and research in South Africa as a participant in an ecology and conservation program



MICHELLE VANHALA

TEACHING AT: Tecumseh High School
LOCATION: Tecumseh, Michigan
HIGHLIGHT: Observed, assisted and taught science and English lessons as an education intern at a junior high school in Cape Coast, Ghana



ALLIE WEBB

TEACHING AT: Columbus Alternative High School
LOCATION: Columbus, Ohio
HIGHLIGHT: Completed an independent study thesis on "Extensions of the Farey Sequence and Ford Circles," as part of her undergraduate studies at the College of Wooster



DWAINA SCREEN

TEACHING AT: East-West School of International Studies
LOCATION: Flushing, New York
HIGHLIGHT: Served as president of Today's Tutors, Tomorrow's Math Teachers as an undergraduate student



JONATHAN SONG

TEACHING AT: University YES Academy High School
LOCATION: Detroit, Michigan
HIGHLIGHT: Served as a team leader and infantryman in the United States Army for four years



TAYLOR WILLIAMS

TEACHING AT: Todd Beamer High School
LOCATION: Federal Way, Washington
HIGHLIGHT: Worked as an engineering intern at Procter & Gamble and conducted research on RADAR imaging systems as a graduate student at Ohio State University, before deciding to become a teacher



MATT WILSON

TEACHING AT: Home Street Middle School
LOCATION: Bishop, California
HIGHLIGHT: Published three scientific journal articles based on freshwater ecology research conducted at the Sierra Nevada Aquatic Research Lab



ROSEMARY WULF

TEACHING AT: Thornton High School
LOCATION: Thornton, Colorado
HIGHLIGHT: Led inquiry physics activities with small groups of elementary and middle school students on a weekly basis through her work with Partnerships for Informal Science Education in the Community

BE A CATALYST FOR TEACHER LEADERSHIP

KSTF teachers continually develop their content knowledge and teaching methods, so they're uniquely positioned to sustain their careers as leaders in the teaching profession. With support from KSTF staff, they build the capacity to improve their own practice and engage in activities that help them drive positive change in schools, districts and national arenas.

ENGINEERING TASK FORCE

Seeing a need for engineering resources generated by teachers who are still in the classroom, KSTF initiated an engineering task force. The KSTF Engineering Task Force (ETF) is made up of 20 KSTF Senior Fellows who are dedicated to integrating engineering into all mathematics and science courses, as spelled out by the new requirements found in the Next Generation Science Standards (NGSS).

Their contributions include:

- designing rubrics to be used to identify and evaluate engineering design projects and student understanding;
- identifying a wind turbine pilot project, documenting how it would be used in their classrooms and developing a plan for gathering data on student learning;
- delivering professional development sessions on using engineering design projects in their local contexts;
- utilizing resources designed by ETF participants with students at The Governor's Institute of Vermont's Engineering Program and the University of Wisconsin-River Falls Upward Bound Program; and
- utilizing resources designed by ETF participants with non-KSTF teachers.

COACHING INSTITUTE

Introduced in 2014, the KSTF Coaching Institute was designed to increase capacity for the use of coaching in KSTF and in broader educational contexts, and to increase the use of coaching

to enhance the climate of shared and reflective professional practice. During its inaugural year, nine KSTF Senior Fellows were selected to participate in the institute. Participants attended two meetings that were developed and presented by staff from BSCS, a nonprofit curriculum study located in Colorado. At the first meeting, participants were introduced to the fundamentals of peer coaching and asked to think about the role of coaches in adult learning. They also considered how these tools could be used to help KSTF Teaching Fellows plan, carry out, and reflect on their summer sessions. At the second meeting, participants practiced using coaching tools to help Teaching Fellows plan, present, and reflect on their summer sessions. They also considered the importance of the different stages of the coaching process and the role of an effective coach in various contexts.

NATIONAL BOARD SUPPORT GROUP

Administered by the National Board of Professional Teaching Standards (NBPTS),

Over 75% of Seniors Fellows and 60% of the 2010 and 2011 cohorts were able to provide examples of influencing positive change beyond the classroom

National Board certification is an advanced teaching credential developed for and by teachers. KSTF Senior Fellow Alison Espinosa, NBPTS-trained Candidate Support Provider, led a one-year program designed to support KSTF Fellows who were applying for certification during the 2013–2014 assessment cycle. Through the program, four Fellows participated in a series of one-on-one and group meetings, and received writing support.

LEADERSHIP GRANTS

In addition to gaining access to a community of leading teachers who are dedicated to improving STEM education, KSTF Fellows are eligible for various forms of financial support. Senior Fellows who have ideas related to the topics listed below are encouraged to apply for a leadership grant:

- improving the teaching profession;
- enhancing STEM teaching and learning;
- providing leadership for other teachers;
- building a network of teachers engaged in new ideas;
- designing a practitioner inquiry group to investigate questions that Senior

The KSTF Senior Fellows Program funds approved projects through a grant process. Information on two recently awarded leadership grants can be found below.

Who: Senior Fellow Kelsey Johnson

School: The Workshop School

Location: Philadelphia, Penn.

Background: In 2012, KSTF Senior Fellow Kelsey Johnson co-founded the Reflective Teacher Network with a colleague. RTN was founded to provide time and space where teacher voice, relationships, and collaboration amongst Philadelphia-based educators is nurtured. In monthly meetings, the facilitators use a

modified Consultancy Protocol to structure small-group conversations to generate practical solutions to relevant problems while also building community.

How Grant Was Used: The grant funds were used to cover the costs associated with maintaining a website and hosting monthly meetings throughout the 2014 calendar year.

Who: Senior Fellow Tracy Schloemer and 2012 Teaching Fellow Ian Caldwell

School: STEM High and Academy

Location: Highlands Ranch, Colorado

Background: STEM High and Academy's mission is to provide students with real-world, relevant, and rigorous learning opportunities to train students for the 21st century. The teachers and administration at STEM High and Academy touted utilization of problem-based instruction, yet the bulk of the staff had no experience, background, or training in problem-based instruction.

How Grant Was Used: The grant funds were used to host a three-day summer workshop for 20 STEM teachers at the school. Led by three master teachers from the University of Colorado Boulder—Julie Andrew, Kim Bunning, and Jeff Writer—the workshop was designed to cover the following topics: improving the consistency of expectations around problem-based learning, assessing exemplar models of problem-based learning, refining a small piece of current curriculum, and setting the stage for quarterly critical friends group meetings that will be held throughout the 2014–2015 school year. Additionally, funds will be used to host the quarterly follow-up meetings which will be focused on topics selected by individual teachers.

A SENIOR FELLOW INTRODUCES THE PATTERNS APPROACH TO THE KSTF COMMUNITY: A PROFILE OF TEACHER LEADERSHIP IN ACTION

What is the Patterns Approach? An approach for teaching physics that emphasizes identifying and analyzing patterns found in nature to make predictions

How was the Patterns Approach introduced to the KSTF community?

Building on similar curricula, including “Modeling Instruction” (Wells, Hestenes, and Swackhamer 1995) and “Investigative Science Learning Environment” (ISLE) (Etkina and Van Heuevelen 2001), KSTF Senior Fellow Bradford Hill developed an original year-long curricular approach entitled Patterns in Nature. Patterns in Nature revolves around the introduction of four patterns—linear, quadratic, inverse and inverse square—to freshmen physics students.

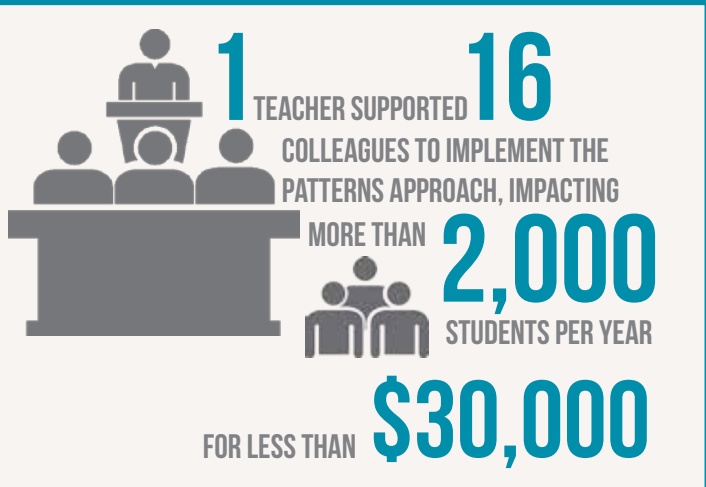
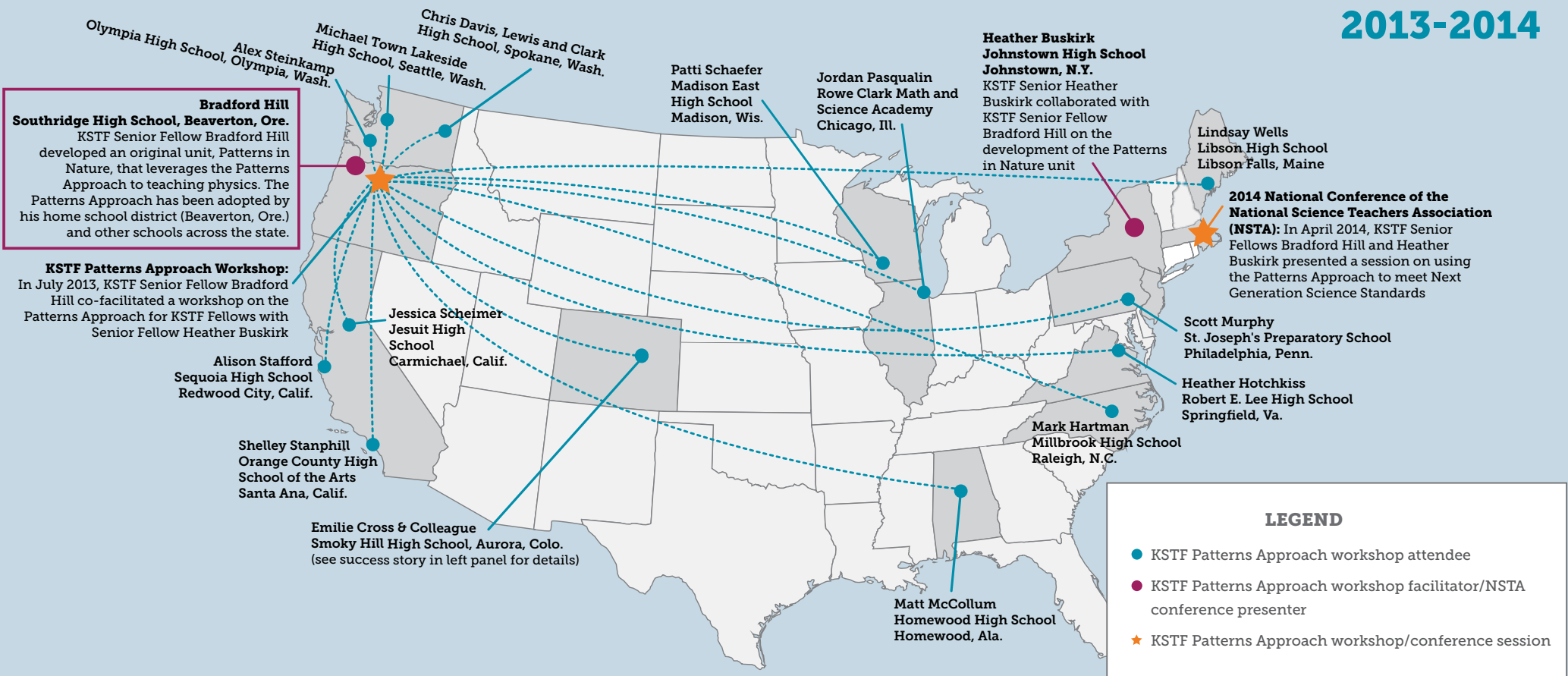
What impact has the Patterns Approach had on the KSTF community?

While in the early stages of developing his curriculum, KSTF Senior Fellow Bradford Hill presented sessions on the Patterns Approach to KSTF Fellows at several summer meetings. In July 2013, Bradford co-facilitated a workshop on the Patterns Approach with KSTF Senior Fellow Heather Buskirk. Held in Portland, Ore., the week-long workshop was attended by 14 KSTF Fellows and the colleague of one Fellow (KSTF Senior Fellow Emilie Cross successfully applied for a KSTF leadership grant for both herself and a colleague to attend the workshop). The workshop resulted in the formation of several special interest groups (e.g., AP Physics, IB Physics, and Freshman Physics). Led by Bradford and Heather, the groups met regularly to discuss issues, challenges, and questions they had around the implementation of the Patterns Approach in their classes.

How has the Patterns Approach had an impact beyond the KSTF community? After further discussion of the topic, KSTF Senior Fellow Emilie Cross and her colleague became convinced that the Patterns Approach should be implemented across their ninth grade science program. Using district teacher work-days, Emilie and her colleague worked one-on-one with the three other ninth grade integrated science teachers at their school to prepare for the introduction of the Patterns Approach at the start of the 2013–2014 school year. It is noteworthy to mention that the Patterns Approach has also been adopted in Bradford’s home district (Beaverton, Ore.) and in other schools across the state.

How can I learn more about the Patterns Approach? Please reference Bradford’s published article on the Patterns Approach to learn more. Hill, B. (2013). The patterns approach: Engaging freshmen in the practice of science. *The Science Teacher*, 80(3), 38-42.

THE SPREAD OF THE PATTERNS APPROACH 2013-2014



KSTF SENIOR FELLOW BRADFORD HILL DEVELOPED AN ORIGINAL CURRICULAR APPROACH, PATTERNS IN NATURE, THAT HAS BEEN SHARED WIDELY WITH KSTF FELLOWS AND OTHER SCIENCE TEACHERS ACROSS THE NATION.

GENERATE AND SHARE KNOWLEDGE

KSTF supports and encourages community members to systematically study their practice and share what they learn with each other, with local colleagues and with relevant stakeholders beyond KSTF, thus expanding the impact of our efforts to improve math and science education. Through discussions, online forums and KSTF meeting presentations, Fellows share their learnings with one another. Additionally, KSTF Fellows share things they've learned from the Fellowship with local colleagues through participation in learning communities, professional development seminars and committee work. Through delivering presentations at professional meetings; participating in forums with other practitioners, researchers and policymakers; and publishing their writing for a range of audiences, KSTF Fellows share knowledge with stakeholders beyond the KSTF community.

PRACTITIONER INQUIRY FOR THE NEXT GENERATION (PING)

Over the course of three years, 10 KSTF Fellows explored teacher inquiry through participation in the KSTF Practitioner Inquiry for the Next Generation (PING) program. Their work was grounded in the ideas developed by Marilyn Cochran-Smith and Susan Lytle in their book *Inquiry as Stance* (2009). The following is a list of papers and presentations generated by PING participants in spring and summer 2014:

- Galosy, J., Portnoy, D., Rostock, R., Vissa, J. & Wolfe, Z. (2014, Feb.). Teacher leadership and beginning STEM teachers: Inroads, barriers, and new directions. Presentation at the 35th Annual Ethnography in Education Research Forum, Philadelphia, PA.
- Henson, K. (2014, April). Science identities in a high school classroom: A year of practitioner inquiry. Presentation at the 2014

National Conference of the National Science Teachers Association, Boston, MA.

- Henson, K. & Echols, R. (2014, Feb.). "I am just a high school student not a scientist..." Stories of practitioner inquiry from inside the classroom and impacts they have on learning (Both for students and the teachers). Presentation at the 35th Annual Ethnography in Education Research Forum, Philadelphia, PA.
- Markiewicz, K. (2014, April). Opening up your door: Fostering teacher-led communities of inquiry and collaboration. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.
- Milks, K. (2014, Summer). What I learned from Rolo. *Educational Leadership*, 66–69.
- Van Tassell, R. (2014, May). The trouble with top-down. *Educational Leadership*, 71(8), 76–78.

PRESENTATIONS AT NATIONAL CONFERENCES

The following national presentations were delivered by members of the KSTF community in fiscal year 2014.

- Barickman, B., Packer, R. & Snodgrass, H. (2013, Nov.) Using the "5 Practices Framework" to facilitate productive classroom discussions. Presentation at the National Association of Biology Teachers' 2013 Professional Development Conference, Atlanta, GA.
- Buskirk, H. (2013, July). Three engineering projects that start with inquiry experiments. Presentation at the 2013 American Association for Physics Teachers Summer Meeting, Portland, OR.
- Buskirk, H., Hill, B. & Holveck, S. Using the patterns approach to meet NGSS in physics. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.

- Gillespie, N. (2014, May) Community, inquiry and leadership: Opportunities that support STEM teacher growth and sustainability. Presentation at the 2014 Physics Teacher Education Coalition Conference, Austin, TX.
- Hartman, M., Weidman, J., Moore, H. & Sabatier, C. (2014, April). Making collaboration worth your time. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.
- Hill, B. (2013, July). Engaging students in the scientific practices using the patterns approach. Presentation at the 2013 American Association for Physics Teachers Summer Meeting, Portland, OR.
- Macway, S. & Nutter, L. (2014, April). Using the 5 practices framework to facilitate productive classroom discussions. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.
- Masloski, K. & Brown, R. (2014, April). Pilot study of the use of teaching replays as a professional development tool. Poster at the American Educational Research 2014 National Meeting, Philadelphia, PA.
- Milks, K. & Traphagen, S. (2013, Nov.). Make student voice real: Motivation, engagement, & community. Presentation at the National Association of Biology Teachers' 2013 Professional Development Conference, Atlanta, GA.
- Schloemer, T & Spencer, J. (2014, April). Reach more of your learners where they are at—Differentiation in the high school science classroom. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.
- Spencer, J. (2014, April). Teachers developing as leaders: A panel discussion.

Panel discussion at the 2014 National Conference of the National Science Teachers Association, Boston, MA.

- Stewart, I. & Lane, J. (2013, Nov.). Nature in the classroom: The power of place. Presentation at the National Association of Biology Teachers' 2013 Professional Development Conference, Atlanta, GA.
- Town, J. (2014, April). 3D print your world. Presentation at the NESTA Share-a-thon at the 2014 National Conference of the National Science Teachers Association, Boston, MA.
- Unruhe, K., Roberts, J. & Fuerst, I. (2014, April). Size does matter!...when it comes to science: Teaching scale in the science classroom. Presentation at the 2014 National Conference of the National Science Teachers Association, Boston, MA.

2010 KSTF Teaching Fellows Brittany Barickman, Rachel Clausen and Helen Snodgrass explored the 5 Practices framework through work completed during year two of the Fellowship. The next summer, seven of the Fellows from their cohort successfully applied for a KSTF grant that covered the costs associated with having a meeting to further discuss their work. The idea to develop a presentation that was delivered at the National Association of Biology Teachers' 2013 Professional Development Conference (and a second presentation that was delivered at the 2014 National Conference of the National Science Teachers Association) was discussed at that meeting.

KSTF Senior Fellows Jim Lane and Isaac Stewart have a deep commitment to using the outdoors to teach biology. An early version of their National Association of Biology Teachers' 2013 Professional Development Conference presentation was delivered at the 2011 KSTF Summer Meeting, followed by a more version refined in 2012. At that time, a KSTF staff member recommended that they submit a proposal to NABT, which was accepted.

KSTF COMMUNITY MEMBERS CONTRIBUTE TO
KNOWLEDGE GENERATION BY QUESTIONING
PRACTICE, BEING CRITICAL CONSUMERS OF
RESEARCH AND SHARING WHAT THEY LEARN

BUILD A NATIONWIDE PROFESSIONAL COMMUNITY

KSTF supports individual teachers through programs that encourage connections among teachers, other members of the KSTF community and the broader educational community. Participating in a national network of education professionals extends teachers’ access to human, social and knowledge capital, allowing them to make an impact beyond their own classrooms.

KSTF Fellows collaborate with teachers in their local contexts, and beyond, to improve STEM education for all students. Here are two brief examples of this type of collaboration.

SPECIAL INTEREST GROUPS (SIGS)

The Fellowship provides support for groups of three or more Fellows to work together in person or online. This includes meetings of KSTF Fellows in a particular region, or Fellows who share a particular interest or concern. Please find a brief description of several existing SIGs below:

- Charlotte Area SIG: A grant was awarded to support monthly dinner meetings for three Fellows in the Charlotte, North Carolina area to discuss issues specific to teachers in North Carolina, as well as broader issues related to STEM education
- Rocky Mountain SIG: A grant was awarded to support six meetings for approximately 10 Fellows in metropolitan Boulder and Aurora (Colorado). The goal of this group is

- to support beginning teachers with roughly one to three years of experience.
- Complex Instruction SIG: A grant was awarded to support monthly meetings for approximately nine Fellows who are interested in complex instruction. The goal of this group is to create an online, publicly available resource center for group worthy tasks and suggestions for facilitating student learning through these tasks.
 - Standards-Based Grading Book Club: A grant was awarded to support the online discussion of Formative Assessment and Standards-Based Grading: Classroom Strategies That Work by Robert J. Marzano by approximately 37 members of the KSTF community.

IB PHYSICS PROFESSIONAL LEARNING COMMUNITY

1. We are open-minded towards the ideas of all group members, respecting that their ideas are as valid as our own.
2. We are committed to staying in alignment with each other because it enables our collaborative community to be more powerful.
3. We make decisions by consensus, because of our commitment to alignment, and because it challenges what we take for granted.
4. We believe that reflection is critical to growth and supports continuous improvement.

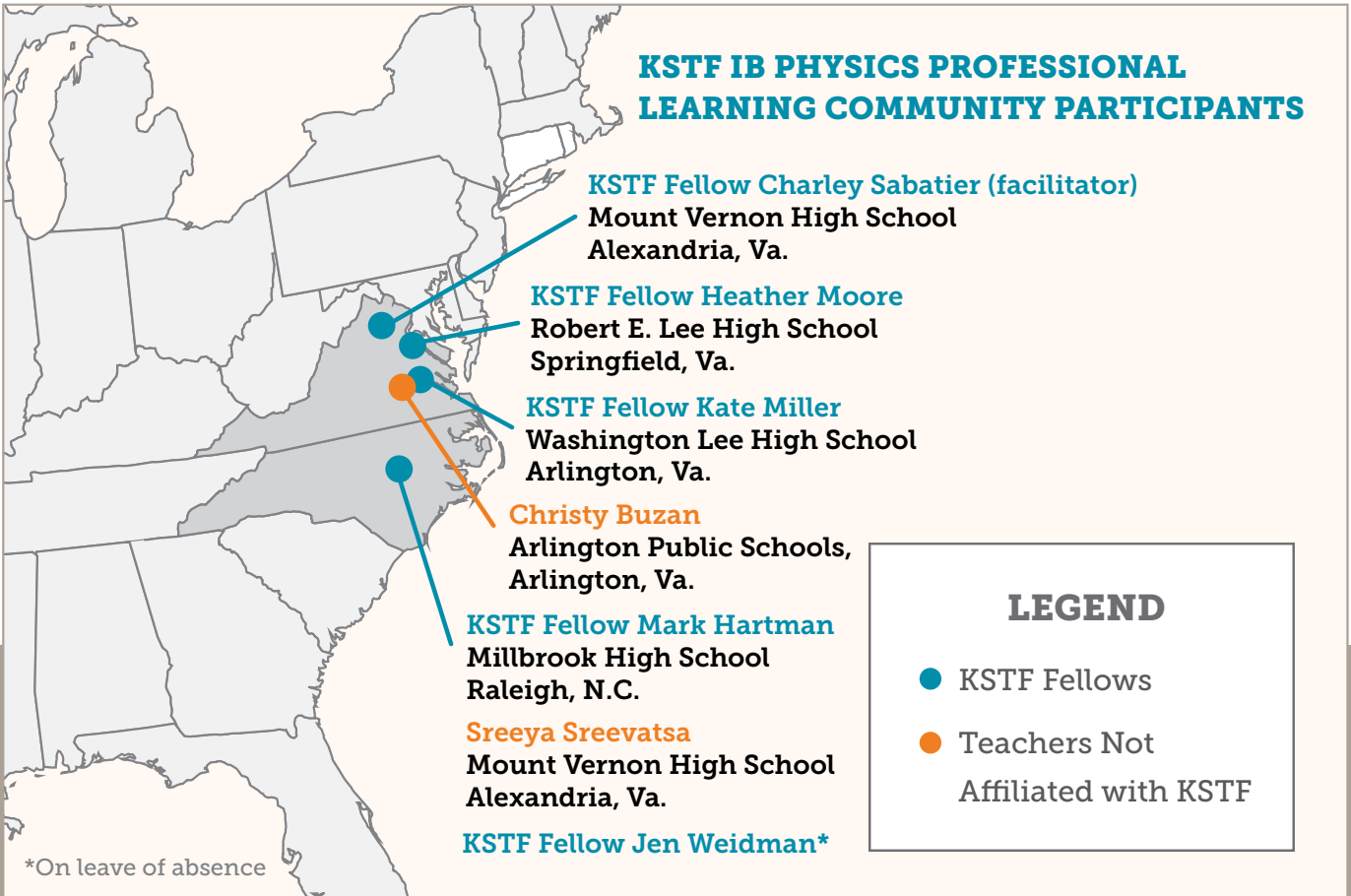
These four statements summarize the “norms” developed and lived by a group of teachers, led by Charley Sabatier, a KSTF Senior Fellow. Together Charley and his group are focused on improving their International Baccalaureate Physics teaching while also feeding their desire to be part of a thriving and intellectually engaging professional community. Now in its 3rd year, the IB Physics Professional Learning Community (PLC) meets on a weekly and monthly basis to design, discuss, and reflect on their IB Physics courses, their teaching challenges and successes, and the collaboration itself. This group is not part of any school or district structure; it is entirely carried out by the teachers involved in the way they decide and for the purposes they choose. By design, this collaboration is more than a planning group. It functions also as a mechanism to provide professional support and intellectual stimulation to the participating classroom teachers, giving them a chance to

challenge themselves and each other in a setting where they feel trusted and safe.

The leadership of Charley and the formation of the IB Physics PLC illustrates how involvement in KSTF catalyzed the desire, wherewithal, and know-how to engage in a mutually supportive and productive collaborative experience. It shows that with KSTF training and support, teachers can create a learning community by themselves, of themselves, and for themselves. The group’s stance is that teachers are responsible for and best positioned to improve their own teaching, and that they can work collectively to do that.

More about this PLC can be found in the following report, which is available at www.kstf.org: Inverness Research Associates (2014, August). KSTF: Cases of Leading Teachers (Report No. ER082015-01).

“THE KSTF COMMUNITY AFFIRMS MY IMPORTANCE AS AN EDUCATOR. THIS SIMPLE FACT HAS GIVEN ME LEVERAGE AND EFFICACY NEEDED TO MAKE CHANGE AT MY SCHOOL.”
- MEGAN GRUPE, 2013 KSTF TEACHING FELLOW



NOW IN ITS 3RD YEAR, THE IB PHYSICS PROFESSIONAL LEARNING COMMUNITY (PLC) MEETS ON A WEEKLY AND MONTHLY BASIS TO DESIGN, DISCUSS, AND REFLECT ON THEIR IB PHYSICS COURSES, THEIR TEACHING CHALLENGES AND SUCCESSSES, AND THE COLLABORATION ITSELF.

A NEW STRUCTURE FOR THE TEACHING FELLOWS PROGRAM

Beginning in fiscal year 2013 and fully implemented in fiscal year 2014, the five-year Teaching Fellows Program was restructured into three phases:

- Phase 1 - years 1 & 2 of the Fellowship,
- Phase 2 - years 3 & 4 of the Fellowship,
- Phase 3 - year 5 of the Fellowship.

A team of two to three Program Officers for Teacher Development with a varied set of professional experiences and expertise—each lead by a Senior Program Officer—implements, studies and refines each phase of the Fellowship. In our former structure, Fellows were divided by content (i.e., biological sciences, physical sciences or mathematics) and by year, which led to staff managing 15 groups, with 15 different trajectories through the Fellowship.

Our goals for making this transition were:

- **To provide Fellows with a more cohesive and consistent experience across the five years of the Fellowship.** In this structure, Fellows make two transitions between teams in the five years. In our former structure, Fellows transitioned up to four times between different Program Officers. Minimizing transitions enhanced our ability to facilitate a coherent, five-year professional development experience across rather than five year-long, loosely coupled experiences.
- **To leverage staff expertise and the KSTF community more effectively to support Fellows in a wide variety of teaching contexts.** Many Fellows teach more than

one subject, so dividing cohorts by content area often deprived Fellows of support in the areas they were least prepared to teach. The new interdisciplinary structure allows Fellows and staff to interact with and learn from each other at the intersections of math and science.

- **To build more resiliency into the structures that support Fellows.** In our old structure, if a Program Officer left KSTF, it was tremendously disruptive to the Fellows' experience in the Fellowship program. In the new structure, even if a Program Officer leaves, Fellows continue to work with a team of staff that know them and what they've experienced together through the Fellowship. The team structure allows staff to build stronger relationships with Fellows over two-year periods. At the same time, it supports Fellows to rely first and foremost on each other as a community rather than only on a staff member as a mentor.

KSTF Teaching Fellowships are awarded based on three criteria: **the potential to develop the content knowledge needed for teaching, the potential to develop exemplary teaching practices, and the potential to develop the qualities of a teacher leader.** These same qualities are emphasized throughout the Fellowship. To complement the new staffing structure, the program was divided into three phases, with each one building on the next. Following is a more detailed explanation of the three phases.

PHASE 1 (YEARS 1 & 2)

During Phase 1, Teaching Fellows inquire into the content knowledge they need to excel in the profession and explore various ways to create and support opportunities for student learning. Fellows come to understand the ways that the content knowledge needed for teaching might be different from content knowledge they developed in other settings and work to deepen and transform their content knowledge in ways that develop their teaching expertise. They develop their understanding of collaborative practitioner inquiry, which allows teachers to explore problems of practice, seek multiple perspectives on those problems, and collect and analyze data that allow them to generate new, useful knowledge about their teaching and their students' learning.

PHASE 1 HIGHLIGHTS

YEAR 1

Year 1 Fellows worked to develop an inquiry stance toward understanding their own content knowledge and teaching practice. As one year 1 Fellow described it:

"Taking an inquiry stance means that you're constantly questioning your practice and collecting information that would help you improve your practice...Taking on an inquiry stance means accepting that your practice can always be investigated and improved."

Another Fellow said, ***"Inquiry stance is being curious about one's own instructional practices and being willing to reflect and take actions to improve those practices. Making observations, examining one's own and others' assumptions, 'experimenting' with approaches, analyzing the results, reflecting, and possibly changing how things are done. It can also mean being curious about what is happening in the school community and thinking about how the situation can be improved."***

YEAR 2

Year 2 Fellows furthered their development of two powerful planning tools—5 Practices for Orchestrating Productive Mathematics Discussions (Smith & Stein, 2011) and 5 Practices for Orchestrating Task-Based Discussions in Science (Cartier, Smith, Stein, & Ross, 2013). Fellows read one of the books (based on content area), discussed its implications, analyzed classroom video with the teacher who implemented it, and went back to their classrooms to implement it. Over 95% of year 2 Fellows reported that the cycles reading about the Five Practices, trying them in their classrooms and reflecting on them with other Fellows was useful to improving their teaching practice.



OVER 95% OF YEAR 2 FELLOWS

REPORTED THAT THE CYCLES OF READING ABOUT THE FIVE PRACTICES, TEACHING IT, AND REFLECTING UPON IT WERE USEFUL TO IMPROVING THEIR PRACTICE

PHASE 2 (YEARS 3 & 4)

During Phase 2, Teaching Fellows further develop their capacity for generating, analyzing, and using data to inquire into their students' learning and their teaching practice. They develop more expansive views of what data might be available to them in their classrooms and schools and learn how to target their data collection and analysis to focus in on goals that are important to them in their practice. This work allows them to develop skill in implementing instructional approaches that account for the diversity of their classroom, draw upon student's individual strengths, seek ambitious learning goals for all students, and capitalize on the resources of their school and communities.

PHASE 2 HIGHLIGHTS

YEAR 3

Year 3 Fellows read and discussed excerpts from the Reflective Educators' Guide to Classroom Research (Fitchman & Yendol-Hoppey, 2009), which described a wide array of data sources that teachers might use to understand multiple perspectives on their practice. Year 3 Fellows shared with one another and analyzed together over 40 different data sources, including not only traditional sources like standardized tests and teacher-designed formative assessments, but also more novel sources like field notes, student work artifacts, student interviews, pictures, videos, surveys and feedback from other teachers. 96% of year 3 Fellows reported that this work contributed to their ability to collect data that contributed to their understanding of their own context. Fellows will grow in their ability to select and share classroom data with each other and contribute meaningfully in understanding others' shared data.

YEAR 4

Year 4 Fellows worked on Complex Instruction with Laura Evans, a highly regarded teacher and coach. Complex Instruction—an instructional approach that utilizes tasks that require higher order thinking and a variety of intellectual strengths—helps students develop collaborative norms and works to broaden their perspectives of what it means to "be smart." Year 4 Fellows reported the work as provoking "a paradigm shift as far as thinking about creating multiple access points to content." Additionally, they reported experiencing "more on-topic related peer-to-peer conversation in my classroom since implementing Complex Instruction."

PHASE 3 (YEAR 5)

During Phase 3, Teaching Fellows focus on the critical need for leading teachers to connect and collaborate with colleagues to improve teaching and learning. Fellows examine what it means to take be agents of educational improvement, in small and large ways, in contexts beyond their own classroom. They identify, plan and carry out actions to improve collaborative work, while also raising questions, generating data, and seeking new perspectives on their school communities. Throughout the process, Fellows expand their understanding of what it means to advance the teaching profession by refining and sharing practice, generating knowledge for themselves and others, and taking on a larger voice in their professional communities.

PHASE 3 HIGHLIGHTS

YEAR 5

Year 5 Fellows worked in small groups on common issues in their school communities. Over the year, these groups shared data with one another from their school settings, looked for common themes, and wrestled with what they could learn from each other's situations.

Fellows appreciated turning the focus of inquiry toward their professional relationships; one remarked, *"Being intentional about observing and learning from my colleagues interactions has been an extremely generative activity for me this year. Just being aware of, and open to surprise, about my colleagues, their motivations, and what contributes toward or detracts from effective professional relationships has been helpful. I have found data analysis of transcripts of meeting to be particularly useful data sources."*

YEAR 3 FELLOWS ANALYZED
OVER 40

DIFFERENT DATA SOURCES—INCLUDING STANDARDIZED TESTS, TEACHER DESIGNED FORMATIVE ASSESSMENTS, STUDENT WORK ARTIFACTS AND STUDENT INTERVIEWS—TO EXPLORE A VARIETY OF QUESTIONS THAT ARISE IN THEIR TEACHING PRACTICE



96% OF YEAR
3 FELLOWS

REPORTED THAT THEIR FELLOWSHIP WORK THIS YEAR CONTRIBUTED TO THEIR ABILITY TO COLLECT DATA THAT CONTRIBUTED TO THEIR UNDERSTANDING OF THEIR OWN CONTEXT

KSTF BOARD OF TRUSTEES



Dr. Suzanne M. Wilson is the newest addition to the KSTF Board of Trustees. Dr. Wilson, a nationally renowned expert on teacher preparation and professional development, is the Neag Endowed Professor of Teacher Education at the University of Connecticut. Previously,

she served as the Chair of the Department of Teacher Education at Michigan State University. Dr. Wilson has been published in *American Educator*, *American Educational Research Journal*, *Educational Researcher*, *Elementary School Journal*, *Journal of Teacher Education*, *Phi Delta Kappan*, *Science*, and *Teachers College Record*. She is the author of *California Dreaming: Reforming Mathematics Education* (Yale, 2003), and editor of Lee Shulman's collection of essays, *Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach* (Jossey-Bass, 2004). She holds an undergraduate degree in history and American Studies from Brown University, and an MS in statistics and a PhD in psychological studies in education from Stanford University.

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Teacher Education,
University of Connecticut

STATEMENT OF FINANCIAL POSITION

Fiscal Year June 1, 2013–May 31, 2014

	FY 2014	FY 2013
Assets		
Cash and cash equivalents	\$ 1,524,689	\$ 2,604,497
Accrued interest and dividends	10,310	10,279
Other receivable	34,828	72,555
Prepaid and refundable federal excise tax	3,097	–
Prepaid expenses	45,196	16,608
Unconditional promises to give	7,181,706	9,111,023
Investments	62,823,282	56,197,030
Property and equipment, net of accumulated depreciation	2,171,985	2,276,495
Deposits	9,195	33,036
Other assets	3,235	–
Total assets	73,807,523	70,321,523
Liabilities and Net Assets		
Liabilities		
Accounts payable and accrued expenses	291,783	317,020
Line of credit	2,050,000	–
Deferred federal excise tax liability	136,357	95,473
Total liabilities	2,478,140	412,493
Net Assets		
Unrestricted net assets	64,147,677	60,798,007
Temporarily restricted net assets	7,181,706	9,111,023
Total net assets	71,329,383	69,909,030
Total liabilities and net assets	\$ 73,807,523	\$ 70,321,523

Full audited financial statements are available upon request

STATEMENT OF ACTIVITIES

Fiscal Year June 1, 2013–May 31, 2014

	FY 2014	FY 2013
Changes in Unrestricted Net Assets		
Support and revenues:		
Contributions	\$ 2,280,141	\$ 1,171,391
Investment income, net	5,987,208	4,298,182
Miscellaneous income	7,510	–
	8,274,859	5,469,573
Net assets released from restrictions	(1,929,317)	1,398,264
Total support and revenues	6,345,542	6,867,837
Expenses:		
Program services:		
Teaching fellows programs	4,597,145	5,008,937
Research programs	843,574	863,498
Senior fellows programs	440,299	312,861
Total program services	5,881,018	6,185,296
Supporting services:		
General and administrative	924,774	664,013
Federal excise tax	48,635	42,975
Total supporting services	973,409	706,988
Total expenses	6,854,427	6,892,284
Increase (decrease) in unrestricted net assets	(508,885)	(24,447)
Changes in Temporarily Restricted Net Assets		
Net assets released from restrictions	1,929,317	(1,398,264)
Increase (decrease) in net assets	1,420,353	(1,422,711)
Net Assets, Beginning of Year	69,909,030	71,331,741
Net Assets, End of Year	\$ 71,329,383	\$ 69,909,030

Knowles Science Teaching Foundation

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