



NOYCE SCIENCE

2012-2022
TEN COHORTS OF TEACHERS



MASTER OF ARTS FOR SCIENCE TEACHING
BRINGS SCIENCE TO LIFE



Nebraska Science Teachers: Persisting and Excelling

The perennial drive to recruit and prepare science professionals to become science teachers requires an enormous, collaborative effort. At the University of Nebraska–Lincoln, we have pledged ourselves to that worthy cause of educating new science teachers. This report summarizes the accomplishments of and celebrates those science teachers who have dedicated themselves to educating diverse youth and fostering a love of science in a world of STEM possibilities. They are the new generation of educators who face, and will continue to overcome, the challenges of education with perseverance and purpose.

From 2011–2016, our first UNL National Science Foundation Robert Noyce Science Teacher grant supported 60 individuals in six cohorts who sought to become science teachers across Nebraska and many other states in high-need school districts. Many of these graduates also have graciously served as outstanding cooperating teachers to individuals in more recent cohorts. Our second Noyce grant made it possible to support 31 more pre-service science teachers with undergraduate degrees in an area of science across four cohorts. Like the six cohorts before them, they enrolled in the Department of Teaching, Learning, and Teacher Education's Master of Arts with emphasis in science teaching (MAst) program. And like their predecessors, they are proving themselves dedicated professionals at a time when we need them in

classrooms more than ever.

In the spring of 2020, MAst Cohort 9 was immediately affected by the global pandemic during the disruption of its student teaching internships, and Cohort 10 was just embarking on its science teacher education program. It would be a massive understatement to say that these have been challenging and stressful times. But it is with great pride that we can report our science education community laudably supported these individuals, and all of these future science teachers persisted, graduated, and accepted science teaching positions. Across all 10 cohorts of MAst teacher graduates, as of April 2022, we are happy to report that 80% who undertook teaching positions are still teaching science.

Nebraska and our nation have been challenged even further by the shortage of science teachers that pre-existed the pandemic, as well as the stark reality of persistent social inequities found in the intersectional spaces of race, gender, class, and disabilities. If nothing else, the pandemic has directed a spotlight on too many critical inequities and where we need to, and must do, better.

While there is important work that must be done, and not nearly enough teachers to do that work, MAst teacher graduates have studied and worked diligently to understand how they can be positive agents of change in secondary schools to promote equity and inclusion with their colleagues, communities, and



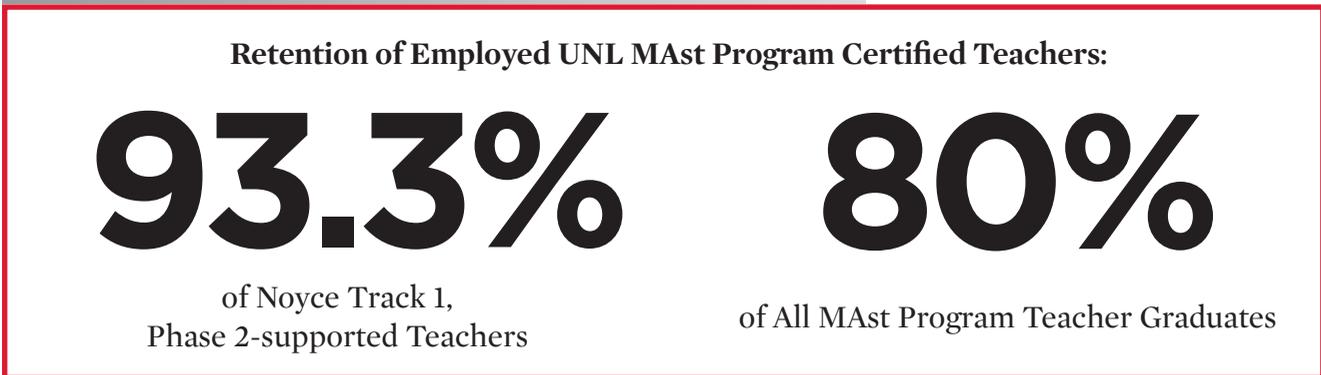
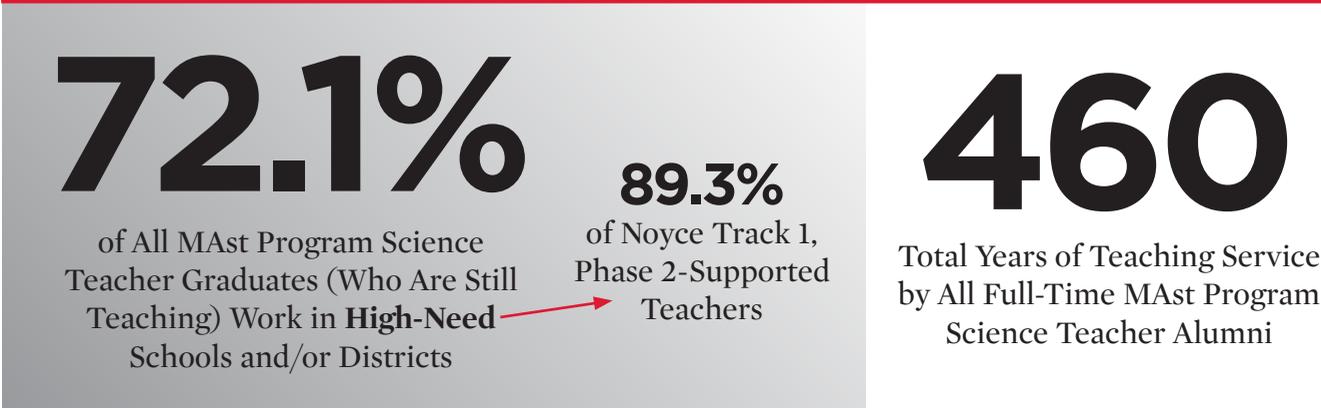
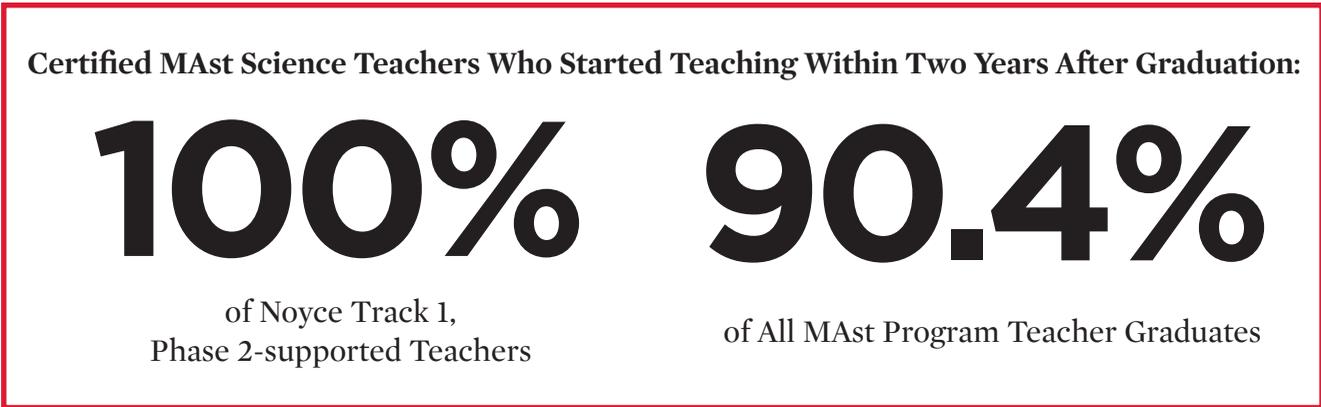
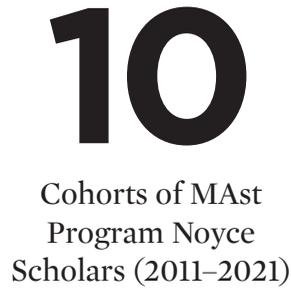
DR. ELIZABETH LEWIS

Noyce Science Teacher Grant, Principal Investigator; Professor, Science Education, Department of Teaching, Learning, and Teacher Education and Science Senior Advisor, Center for Science, Mathematics, and Computer Education, UNL

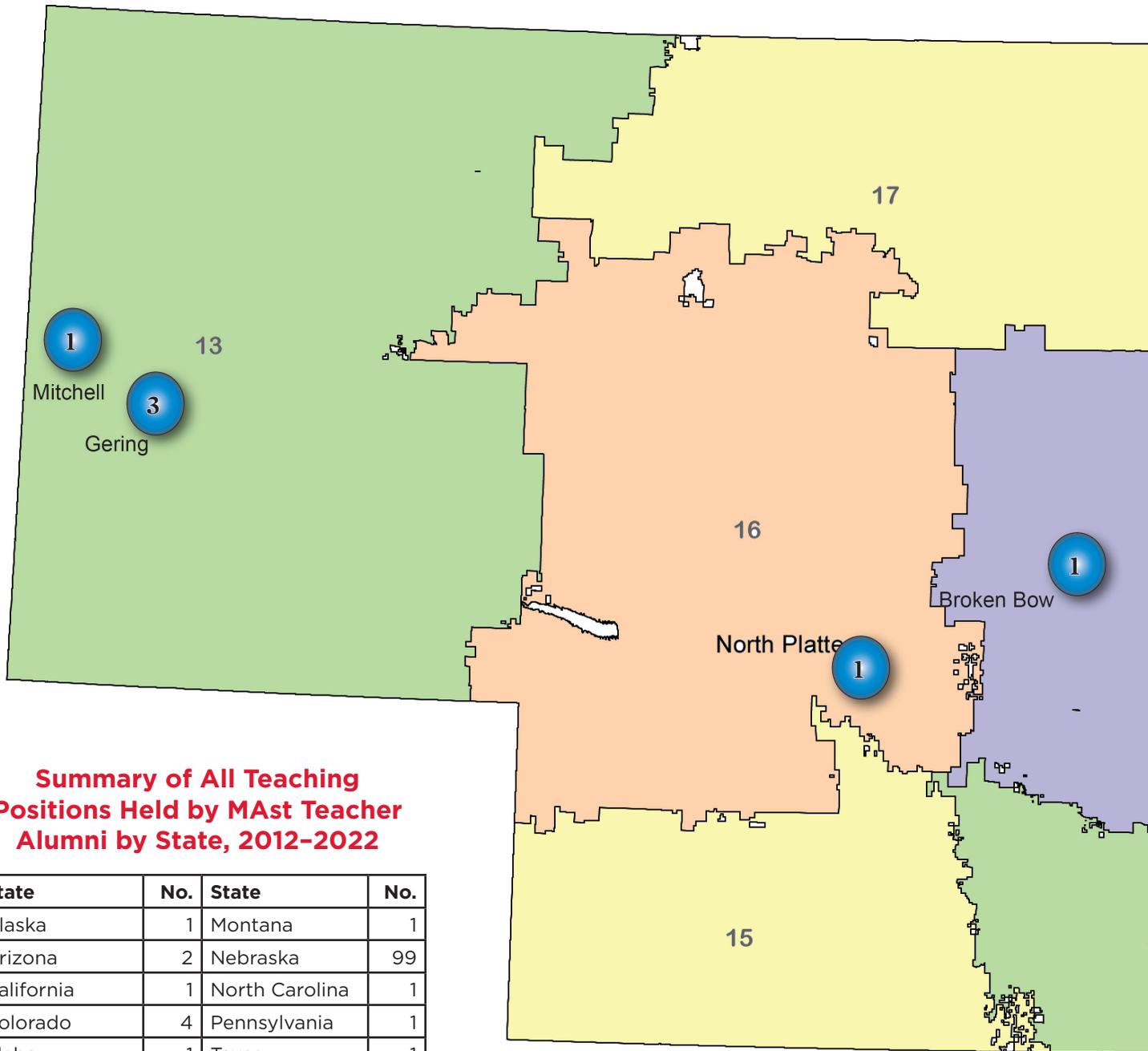
diverse students. They have sought teaching positions in high-need schools across Nebraska and the U.S. and have worked tirelessly to provide meaningful and experiential learning opportunities for their students. We could not be prouder nor more hopeful that these 10 cohorts of remarkable individuals are strong advocates for their students, science education, and their communities.

We humbly thank our school partners, cooperating teachers, university supervisors and instructors for their compassionate and diligent work and heartily congratulate all of our MAst teacher alumni who have made a real difference in the lives of their students and their families.

BY THE NUMBERS



Cities with Schools with All Teaching Positions Held



Summary of All Teaching Positions Held by MAST Teacher Alumni by State, 2012-2022

State	No.	State	No.
Alaska	1	Montana	1
Arizona	2	Nebraska	99
California	1	North Carolina	1
Colorado	4	Pennsylvania	1
Idaho	1	Texas	1
Iowa	1	Utah	1
Kansas	1	Virginia	2
Missouri	3	Wisconsin	1
Total Teaching Positions Held			122

Bringing Wildlife to Life

Former Outdoor Educator Uses His Experience to Create Enriching Zoo Program for OPS Students

As zoo focus education program director at King Science and Technology Magnet Center for Omaha Public Schools, Carter Shank fuses his former work experience with the Game and Parks Commission with his passion for teaching.

“

This was my opportunity to take my outdoor education experience and translate it into a meaningful classroom experience for students.”

CARTER SHANK

In courses such as zoology and zoo architecture, middle school science teacher Shank gets to share with his students the fascinating world of wildlife and the science behind it.

The Nebraska native earned a Bachelor of Science in biological sciences and a Master of Arts in science teaching (MAst), both from the University of Nebraska–Lincoln. Shank was awarded an NSF Noyce teacher scholarship for his MA-level science teacher education program. Shank initially was accepted to graduate school for parasitology, before working as an outdoor educator for Game and Parks. He quickly realized he wanted to expand upon his experience in education.

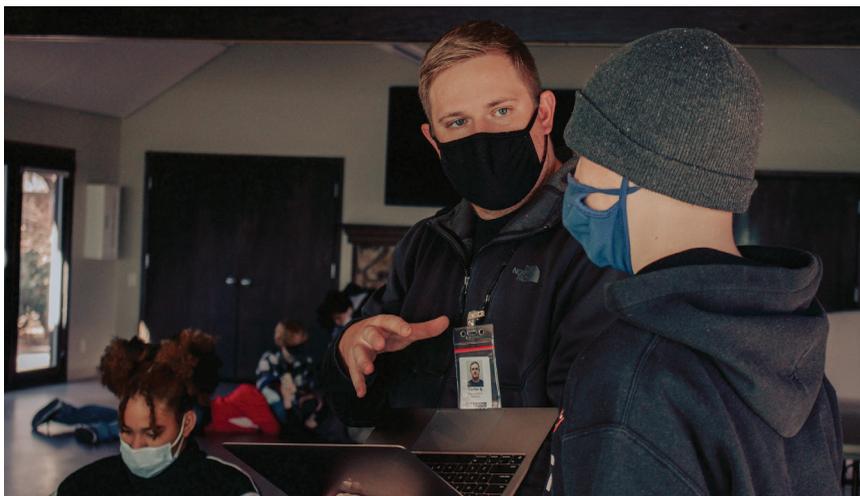
When Shank heard about the MAst program, he immediately

applied. “This was my opportunity to take my outdoor education experience and translate it into a meaningful classroom experience for students,” Shank said.

Shank began teaching 6th grade general science and then transitioned into 8th grade science and honors physical science before his current role as an OPS science teacher in partnership with the Henry Doorly Zoo.

His teacher education program also helped him to become a more well-rounded educator, in particular with understanding and preparing individualized education programs for students with special needs, technology, and culturally responsive pedagogy.

“The special education training set me up to help work with my school’s resource department in helping differentiate my lessons for students with IEPs. The technology in the classroom course has greatly helped me teach in our virtual environment during the COVID pandemic. I also work in a minority-majority school district, and I appreciate having had the Teaching in a Pluralistic Society course to help me work best with students that come from cultural backgrounds





PHOTOS BY GRACE KOVAR | UNIVERSITY OF NEBRASKA-LINCOLN

(Above) A student in Carter Shank's King Science Zoo Career Program reads the jellyfish display at the Henry Doorly Zoo in Omaha. (Page 6) Shank (center) talks with a student before the class heads to the aquarium.

dissimilar to my own," Shank said.

One of the most impactful benefits of the MAsT program, Shank said, was the tight-knit cohort. A support system was created that helped to facilitate the growth of the students in it.

"Getting to work with the same small cohort of master's students was a great way to keep up with one another's experiences, faults, and successes," Shank said.

Driven by his love for what he teaches, Shank has been involved with extracurriculars such as Science Bowl, Science

Olympiad, and local and national-level science fair projects.

"All of these opportunities have given me an even deeper understanding of my students' needs, which I can translate to my classroom as well as watch them succeed and become greater scientists in their own right through their personal investigations," Shank said.

In the near future, Shank is transitioning from teaching middle school to teaching high school. He will be joining Lincoln Public Schools in the fall of 2022 as a science teacher.

Long term, Shank hopes to complete his Ph.D. with a focus in either science curriculum or the efficacy of multi-dimensional, project-based learning in science classrooms. He also is looking to resume participating in research in evolutionary biology.

"My favorite part of teaching science is the chance to observe the 'Eureka' moment that happens when a student realizes a scientific pattern or is able to solve a problem through their own understanding of a scientific concept," Shank said.

BY TORI PEDERSEN, UNIVERSITY OF NEBRASKA-LINCOLN

Q&A

Supported by an NSF Noyce Scholarship, Teacher Changes Careers from Veterinary Medicine



GRACE KOVAR | UNL
Mimi Harvey (center) prepares her animal science students for a lab activity at Bryan High School.

After graduating with a doctorate in veterinary science, Omaha Public Schools teacher Mimi Harvey started her journey with the Noyce MAST program with Cohort 10. Originally from Lincoln, Harvey teaches at Bryan High School in the Urban Ag and Natural Resources Career Academy.

Q: What made you decide to become a science teacher through the MAST program?

The program was exactly what I was looking for when I made the decision to return to school for my teaching credentials. I knew I wanted more than a program that just offered a teaching certificate at the end. I wanted to be as prepared as I could be to make the career change and the added courses for the master's degree was appealing.

Q: Where do you teach now and which subjects? How long have you been there?

I currently teach at Omaha Bryan High School in the Urban Ag and Natural Resources Career Academy. I teach Animal Science, Food Science, and co-teach Introduction to Agriculture and the senior capstone classes. This is my first year here.

Q: How did the MAST program prepare you for teaching effectively?

There was a wide variety of different courses that focused not only on the methods of teaching science, but also on how to better understand our students with different learning

needs or experiences, as well as understanding the theories of curriculum and teaching.

Q: Describe your favorite experience in the Noyce program.

I liked the small cohort setup for the program and that it was combined with undergraduates for the science teaching methods courses. This allowed me to create relationships and support networks that I have relied on during this first year of teaching.

Q: What excites you about teaching science?

I love when kids have the “a-ha” moments and understand how something they see every day occurs or finally get a concept that they have been struggling with.

Q: What are your future goals in your teaching career?

I would like to continue with the Ag Academy and help it grow as OPS moves to the wall-to-wall academy model within the district. I would also like to someday get back into veterinary medicine by teaching at a veterinary technician/veterinary school in at least an adjunct faculty position.

Q&A

Environmental Science Course Culminates with River Trip

Originally from Carlisle, Pennsylvania, Spencer Powell teaches AP Environmental Science, Freshman Environmental Science, and Outdoor Wilderness Leadership (OWL) at Central High School in Grand Junction, Colorado. In Spring 2021, Powell took a group of students on a rafting trip down the Colorado River.

Q: How long have you been taking students on experiential learning trips?

Through the OWL program, I've been involved in outdoor education for about seven years. Last year was my first time taking a group of students on a rafting trip down the Colorado River.

Q: How do students engage differently on these trips compared to in the classroom?

The biggest thing that comes from these trips is students making true, real-world connections. Engaging in real science in the field helps bring to life some of the labs we did in class.

Q: Do you have a favorite story to share from one of your trips?

The morning before we left our camp along the Colorado River, students worked with multiple scientists to release gall wasps on invasive Russian knapweed. I absolutely loved seeing them use skills and techniques we learned in class actually out in the field.

One of the first labs we did for AP Environmental Science was a quadrat survey of the school's soccer field for biodiversity. Students then used those skills monitoring quadrats along the Colorado River right before they released their wasps. Next year, hopefully we will find established wasp communities in the place were they were initially released.

Q: How did the Noyce program impact your teaching experience?

I got to learn from, and work with, great teachers who are passionate about science teaching. Also, being part of a community that I'm still in contact with almost 10 years later is really special.

Q: What was your favorite experience in the Noyce program?

I had the opportunity to go to a conference at Kennedy Space Center with a group of Noyce teacher grads. That was



an amazing and memorable experience and definitely a highlight of being in the program.

Q: Do you have any advice for how other schools can create similar experiences for their students?

These trips for us are only possible with a variety of community partners. We partnered with National Environmental Education Foundation, Colorado Canyons Association, Colorado Parks and Wildlife, and Bureau of Land Management, as well as some other local partners. My advice is for teachers to reach out to local and national conservation and educational organizations for help with funding as well as organization.

View videos from Powell's rafting trip at: go.unl.edu/noyce-powell

Problem-solving Pursuit

Chemistry Teacher Strives to Make STEM Learning Accessible to All Students

From the time she could hold a pencil, Kathryn Miller-Krivanek was preparing to lead a classroom full of students. The first of these students were her younger brothers, whom she forced to sit down and play school with her while they were children.

“While there was not really a definitive moment where I realized my passion for teaching, I felt in my heart that it was something I would enjoy,” Miller-Krivanek said.

Miller-Krivanek’s focus on exploring STEM fields (science, technology, engineering, and mathematics) began in high school, attending Omaha North High School, which is a STEM magnet school. Miller-Krivanek quickly found that she loved problem solving.

“It was particularly fascinating to see how an equation could concisely represent a complex and sometimes microscopic system,” Miller-Krivanek said.

She went on to pursue a degree at the University of Nebraska–Lincoln in chemistry, with minors in education, physics, and mathematics.

“I felt that it was important to have a deep understanding of chemistry to be a well-qualified chemistry teacher,” Miller-Krivanek said.

Toward the end of her undergraduate education,

Miller-Krivanek met with program coordinator Dr. Elizabeth Lewis to discuss the Noyce scholarship and MAst program. Miller-Krivanek felt it was the perfect chance to pursue her dream of going into science education.

The MAst program offered Miller-Krivanek the opportunity to develop critical skills. She learned curriculum design, lesson planning, assessment, and classroom management skills that have prepared her to be a successful educator.

Beyond fostering foundational teaching skills, the MAst program gave Miller-Krivanek the opportunity to conduct teacher action research to discover how to better serve students who belong to marginalized groups.

Miller-Krivanek’s capstone project focused on investigating the effects of feedback and revision of science writing by English language learners. “Through this experience, I gained the skills necessary to be a reflective teacher. I learned how to use assessment data to revise my lessons to improve learning outcomes for all students and increase access to all students, including those from marginalized groups.”



Kathryn Miller-Krivanek introduces the day’s chemistry lesson at Bryan High School in November 2021. Miller-Krivanek was a member of the seventh cohort and graduated from UNL in 2018.



PHOTOS BY GRACE KOVAR | UNIVERSITY OF NEBRASKA-LINCOLN

She explained that the growth she sees in her students' problem solving — independence — encourages her to continue teaching. The reward of watching students learn to explain scientific phenomena continues to inspire her.

Currently a teacher at Omaha Bryan High School, Miller-Krivanek collaborates with other MAst graduates who teach at her school, and they often

share ideas and advice on how to improve students' learning.

"At the end of each instructional unit, I take time to reflect and consider how I could adjust my future lessons to meet the needs of my students," Miller-Krivanek said.

In the near future, she hopes to continue her development by becoming a National Board Certified teacher. Additionally, she works to develop a more hands-

on, rigorous curriculum that aligns with Nebraska's College and Career Ready Standards for Science Chemistry Plus standards. "I hope this development in curriculum will shape students' ability to actively engage in their learning and prepare them for their future," Miller-Krivanek said.

BY TORI PEDERSEN, UNIVERSITY OF NEBRASKA-LINCOLN

Research on Science Teaching Supported by NSF Noyce Grants

Research supported by the National Science Foundation (NSF) Robert Noyce, Track I, Phase II grant facilitated a longitudinal study of how early- and mid-career science teachers enacted inquiry-based instructional practices. This study built upon the previous Noyce Track I, Phase I grant that supported the development of UNL's 14-month master's level teacher preparation program (MAst).

Context

The MAst program recruits science professionals to a research-informed teacher preparation program that addresses diversity, equity, and inclusion in secondary science classrooms. Both NSF Noyce grants provided pre-service stipends. The UNL Noyce Track I, Phase II grant research team, led by TLTE faculty member Dr. Elizabeth Lewis, sought to better understand how science teacher graduates were teaching, in essence observing how teacher preparation was translated into practice. They observed early- and mid-career alumni teachers who taught science in over 20 different school districts. Researchers were also able to observe how two models of teacher preparation functioned at the same institution: (a) the four-year undergraduate secondary science education major with a specific science area minor that met the state's minimum certification requirements, and (b) the MAst program for secondary science teachers with undergraduate majors that meets the federal definition of a "highly qualified teacher."

MAst Program Design

The MAst program was designed using Darling-Hammond and Bransford's (2007) vision of professional practice that describes a comprehensive teacher knowledge framework for educating a new generation of teachers. The three major intersecting areas are: (a) learners and their development in social contexts, (b) subject matter and curriculum goals, and (c) teaching.

Other research about the importance of preparing teachers to teach diverse students was used to inform the selection of foundational coursework, specifically teaching multilingual learners and equitable education. MAst teachers also learned how to design teacher action research and conducted their own capstone study during their student teaching.

Research Design

The comparative study used pre- and post-program graduation data, a rare design due to its difficult nature of obtaining research approvals in so many different school districts as teachers were hired to teach. This dataset includes: teacher and school demographic information, science subject matter knowledge, clinical experiences, pedagogical knowledge, instructional practices, teaching self-efficacy, and beliefs about reform-based science teaching and learning. Another research goal was to disseminate key findings on science teacher preparation program design and teacher effectiveness to stakeholders such as teacher educators, science education leaders, science teacher associations, administrators, and policymakers.

Conceptual Framework: Science Teacher Preparation

The research base has provided little empirical evidence of what knowledge and skills science teachers need to be effective teachers. Existing research pertaining to science pre-service teachers has been limited in: (a) mastery of discipline-specific subject matter knowledge, (b) teaching self-efficacy, (c) curricular practices, and (d) clinical experiences (NRC, 2010). A critical report on teacher preparation produced by the National Research Council (2010) called for educational researchers to investigate the transfer of teacher preparation knowledge and skills to the classroom.

The STEM Future Is Bright

LPS Physics and Astronomy Teacher Uses Research to Inspire His Students to Become Scientists

Ethan van Winkle values how **research and teaching work together**. Since his time as an undergraduate, he has sought to pursue a career to pair the two.

“The field of science grows in two ways: by furthering the knowledge in research and from inspiring students to become future scientists,” van Winkle said.

For seven years, van Winkle has been a science teacher at Lincoln Southeast High School. His courses include Differentiated Physical Science and Physical Science for incoming freshmen and Astronomy, Differentiated Physics, and Physics for sophomores through seniors.

In 2021, van Winkle was accepted into the NASA/IPAC Teacher Archive Research Program. He is one of only a handful chosen in the United States. The program gets educators involved in authentic astronomical research, partnering small groups of educators with a mentor and professional astronomer for a yearlong original research project using NASA’s vast archives of astronomical data from space- and ground-based telescopes. In exchange, educators are asked to leverage this experience by providing professional development for their colleagues in their local school districts.

Van Winkle, originally from Grand Island, earned a Bache-



COURTESY PHOTO

Lincoln Southeast High School teacher Ethan van Winkle (left) guides students through the “Skateboard Across the Universe” project. Each student keeps track of the time for a certain position and plots the data. They see what graphical relationships are displayed for position time, velocity time, and acceleration time when pulled with a constant force.

lor of Science in physics with an emphasis in astronomy and minor in mathematics from the University of Nebraska–Lincoln in 2015. Having been introduced to research in the fields of STEM, van Winkle realized that next he needed to learn how to be an educator.



Research experiences have allowed me to be a better source of knowledge for my students.”

ETHAN VAN WINKLE

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“After I graduated with my physics degree, I had no formal exposure to educational pedagogy, and I knew that I needed to fill that void. The Noyce MAst program introduced me to the proper foundations of



how people learn and how to be a guide for them,” van Winkle said.

One of the characteristics of the Noyce program that stood out to van Winkle was the way it brought together individuals who all had field experience but little experience in education.

“I just loved having a group of individuals who were all dedicated to growing in this new area

that no one originally had,” van Winkle said.

He also attended the Midwest Noyce Connections Conference at the Kennedy Space Center in 2016, a grant from the National Science Foundation to the UNL Center for Science, Mathematics and Computer Education.

While the MAst program lasted only 14 months for van Winkle’s cohort, there was constant exposure to classroom teaching as well as practicing and honing skills of the craft. Individuals took their field knowledge, paired it with educational pedagogies taught to them in the classroom, and within weeks began applying it in their own classroom setting.

“My favorite part about teaching science is the ability to give students access to understanding their surroundings

and seeing how the tools I teach them in the beginning of the class can be helpful in their pursuit of knowledge,” van Winkle said. “It is a wonderful experience to watch, when students start realizing this as a community by having rich, purposefully guided discussions generated by authentic lab experiences.”

In the future, van Winkle hopes to continue to take advantage of future opportunities to bring research into his teaching. He is looking to expand his curriculum to target students’ critical thinking abilities and develop those skills through inquiry-type lessons and open-ended assessments.

“Research experiences have allowed me to be a better source of knowledge for my students,” van Winkle said.

BY TORI PEDERSEN, UNIVERSITY OF NEBRASKA-LINCOLN



LINDSAY AUGUSTYN | UNIVERSITY OF NEBRASKA-LINCOLN

Ethan van Winkle (fourth from left in glasses) participates in a workshop with other Midwest Noyce Scholars to create lesson plans together, with the goal of leaving with enhanced understanding of NASA and space science, during the 2016 Midwest Noyce Connections Conference at the Kennedy Space Center in Florida.

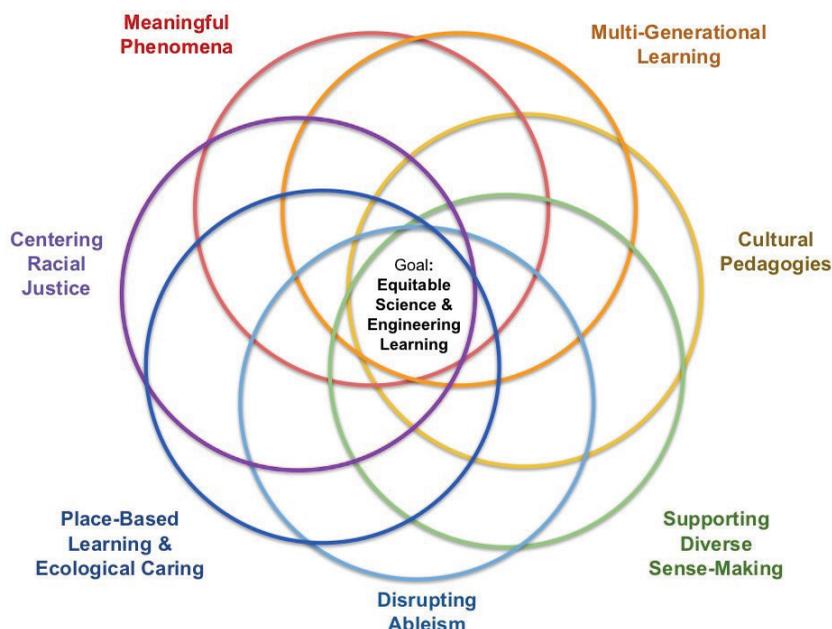
Noyce Science Enters a New Phase

Retaining Exemplary Science Teachers and Strengthening Science Education Leadership

The National Science Foundation has awarded a group of faculty members at the University of Nebraska–Lincoln a grant to fund the project “Meeting the Needs of Diverse Students through a Next Generation of Science Teacher Leadership in Nebraska.”

The group is in the process of recruiting and developing 26 secondary science teachers as Noyce Master Teaching Fellows (MTFs) to become educational leaders with a strong focus on equity and inclusive science teaching and learning in Nebraska secondary schools.

The six-year, \$2.9 million grant from the NSF’s Robert Noyce Teacher Scholarship Program, with another \$1.4 million in matching funds from project partners, is being led by Dr. Elizabeth Lewis, professor of science education in the Department of Teaching, Learning, and Teacher Education. The first cohort of 12 MTFs has enrolled in a rigorous educational specialist degree program focusing on science education and equity, teacher leadership, and science content for teaching. They are required to maintain their classroom teaching practice for five years and complete an educational specialist degree program. Each teacher will be provided a salary



<https://sites.google.com/view/acesseproject/home>

supplement of \$11,000 per year.

“Access to science education-focused, long-term professional development opportunities has historically been challenging for teachers, especially those in rural schools,” Lewis said.

Co-principal investigators include Husker faculty members Dr. Wendy Smith, research professor in the Center for Science, Mathematics and Computer Education and mathematics; Dr. Dan Claes, professor and chair of physics and astronomy; Dr. David Harwood, professor of Earth

and atmospheric sciences; and Dr. Gina Matkin, professor of agricultural leadership, education, and communication. With their interdisciplinary expertise, the team has developed the new NSF-funded program with a careful collaboration across their three colleges—Education and Human Sciences, Arts and Sciences, and Agricultural Sciences and Natural Resources—and the project is also supported by the UNL Office of Graduate Studies. Other project partners

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include Nebraska's largest public school systems, Grand Island, Lincoln, and Omaha; the Nebraska Association of Teachers of Science; and the Nebraska Department of Education. Collectively, they will mentor and develop a greater capacity for science teacher leadership to meet science education priorities in Nebraska.

As they progress through the program, these UNL Noyce MTFs will develop professional development opportunities for teachers to attend to the learning needs of all students including a careful focus on historically minoritized students in science. Ultimately the goal will be to generate positive and empowering student science identities at the intersections of culture, race, gender, and special needs and talents. UNL Noyce MTFs will complete and share leadership projects situated in their own classrooms and school districts with other science teachers, curriculum coordinators, and leaders through state, regional, and national networks.

"We hope that the project's vision and activities will inspire not only these science teachers, but also others statewide to generate a ripple of broader, positive impacts on all students' science education," Lewis said.

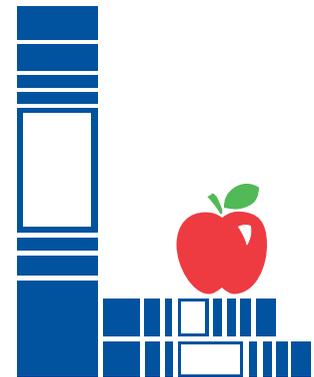
UNL MTFs also will complete National Board Certification, the most respected professional certification available in K-12 education. This program will more than double the number of National Board Certified secondary science teachers in Nebraska.

Cohort 1 Noyce Master Teacher Fellows Span the State of Nebraska

Through a two-phased rigorous application process, 12 secondary science teachers comprise the first cohort of UNL Noyce Science MTFs. Teachers from school district partners are: OPS middle school science focus program teacher Samia Eltouny and high school biology teachers Royonna Bristol and Kristoff Berzins; LPS middle school teacher Lora Carpenter-Janike and high school physics teacher Ethan van Winkle; and Grand Island integrated science high school teacher Jolyne Zigler. They are joined by Hemingford science teacher Peter Gomez, North Platte high school biology teacher Scott King, Kearney high school physical science teacher Alison Klein, Westside Community Schools high school chemistry teacher Kim Gradoville, Columbus Lakeview high school biology teacher Nicole Miller, and Millard middle school teacher Corey Gallegos.

Recruitment of another 14 UNL NSF Noyce science MTFs will start in the summer of 2022. The program website and application directions can be found at: <https://cehs.unl.edu/tlte/nsf-noyce-master-teaching-fellows-program>.

The NSF grant and scholarship program is named for Robert Noyce, who co-founded Intel and invented the integrated circuit, which sparked the personal computer revolution. Noyce cared deeply about the dwindling number of students heading into STEM careers.



Lincoln Public Schools



FROM PAGE 12

In response to this call, the UNL program of research addressed this knowledge gap by investigating science teachers' NGSS-aligned instructional practices with a range of in-field content knowledge and relationships to exemplary, reform-based instruction (Figure 1).

They posed the following questions: (1) Becoming an effective teacher takes "good" preparation, but how much content, time, and practice? (2) Pre-service teacher education, even robust preparation, cannot immediately prepare teachers to be effective teachers, which preparation elements and designs are better than others? and (3) When do the effects of teacher preparation programs attenuate?

Research Findings

Through comparing the two teacher preparation programs, researchers found that greater inquiry-based science teaching was tied to three specific factors (Lewis et al., 2021): (1) stronger subject matter knowledge, (2) more teaching experience, and (3) teaching science with an in-field certification. Teachers with an MA in science teaching tended to teach more inquiry-based lessons than the teachers in the bachelor's track as they had an in-field degree in their content area versus only a minor in their area. Teachers with more experience, started higher and continued to increase their use of inquiry-based teaching methods in their lessons. Teachers who taught in their area of expertise leveraged more inquiry-based curriculum and instruction. Experience and depth of knowledge was found to be significant for each subject area, but physics teaching also relied upon strong mathematical knowledge in addition to physics coursework to be significant to teachers' depth of knowledge.

Another sub-study included four to six observations of 27 to 43 teachers per year and follow-up interviews. The UNL researchers collected 801 weeks of data from a total of 56 teachers. After each observation by the research team, the researcher conducted a follow-up

Number and Percent of Lessons Taught by Teachers in Study, Teaching Experience, and Teacher Preparation Program Membership

Teaching Experience	1 year	2 years	3 years	4 years	5 years	6 years	All Lessons by Program
MA Program (n)	101	96	123	101	63	30	514
%	13.0	12.3	15.8	13.0	8.09	3.85	66.0%
UG Program (n)	79	60	56	42	13	15	265
%	10.1	7.70	7.19	5.39	1.67	1.93	34.0%
						Total:	779 lessons

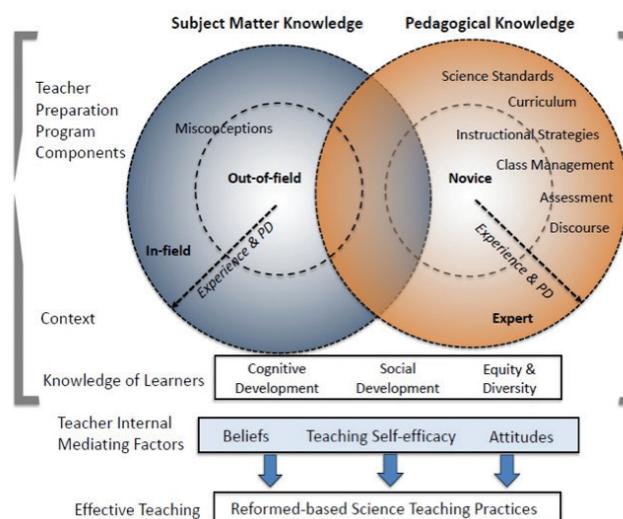


Figure 1. Conceptual Framework of Science Teacher Preparation (from Lewis et al., 2020).

interview to ask teachers to summarize their weekly instructional practices that had not been directly observed. Analysis of teachers' use of NGSS scientific practices found that they differed by subject matter, with physical science teachers' lessons integrating more scientific practices than life science teachers' lessons. The largest difference was in the use of mathematical and computational thinking, which was used on average in 59% of physics lessons per week and 52% of chemistry lessons, but only in 12% of biology (9-12) and 6% of life science (6-8) lessons (Tankersley, et al., in prep.).

Conclusion

These findings provide a basis for empirically informed recommendations regarding state-level teacher certification policy that are often ignored in favor of other agendas, political or otherwise. And the study of NGSS scientific practices show us where greater effort needs to be taken to prepare and support science teachers' standards-based teaching. See **References** on page 23.

MAst Teacher Alumni News

Melanie Burke



Previously, I taught chemistry at Omaha North High School and then biology and chemistry at

Millard North High School when I had my second child. Lewis was born with a rare Congenital Heart Defect called Hypoplastic Left Heart Syndrome (HLHS). Essentially, he only has half of a heart. With multiple surgeries, heart failure, and frequent hospital stays it became apparent that being his full-time caretaker was where I was needed. This is my second year staying at home full time while taking care of Lewis's medical needs, as well as my two other children. I teach Lucy, my oldest, and Lewis preschool at home. My plan is to return to teaching once Lewis has his next surgery and is able to go to kindergarten.

Blair Burson



I spent the past five years teaching middle school science in Omaha Public Schools at McMillan Magnet Middle

School and made a move out to Gretna Public Schools at the start of this school year. I am still teaching 7th-grade Science and am enjoying all the changes. While at OPS, I was able to write middle-level science curriculum units for two summers, and I grew tremendously as a professional. I am looking forward to continuing to grow with Gretna Public Schools.

Melissa Crabb



I am teaching 7th-grade science in York, Nebraska. I am also participating in UNK's leadership

academy this semester. My husband and I welcomed our first child in February 2022. We are very excited to become parents and welcome our little girl.

Jackson Fischer



I am an 8th-grade science teacher at Millard Central Middle School in Omaha. I coach track, football, and

basketball at the school as well. I started an online master's degree in biology program at UNK to further my education in my content area.

Jami Foster



After graduating from the Noyce program in 2017, I spent four years teaching secondary

science at Cedar Bluffs Public Schools. Last June, I started at the Nebraska Department of Education's Office of Career and Adult Education as the Health Sciences Career Field Specialist and HOSA State Advisor. In my role, I support Nebraska Health Science programs, coordinate HOSA | Future Health Professionals events, lead professional development, and provide technical assistance for Perkins grant recipients. I am really enjoying my new role.

Samantha Lowery



I am currently a science teacher at Lincoln Southeast High School. I teach Biology, Chemistry, and Forensic

Science. I am also the camp director for Camp Cornhusker with the Cornhusker Council Boy Scouts of America. I have been married to my husband, Stephen, for seven years, and we have two wonderful boys, Tommy (3 years) and Charlie (6 months).

Taylor Montgomery



I am currently teaching Physical Science, Biology, Zoology, and Botany at Gering High

School in Gering, Nebraska. At the end of this school year, I will be returning to Grand Island Senior High, where I taught previously for five years. My wife, Shawna, and I have a 14-month-old daughter, Elliette. Shawna and I met while both teaching science at Grand Island Senior High in 2018. She will be returning with me to teach there to start the 2022-2023 school year.

Brett Moser



I am a science teacher at Gering High School in Gering, Nebraska. I teach Physical Science,

Forensic Science, Aviation, and Physics. I moved here right after graduating and have been here ever since. I married a local a

few years ago, and we have two kids running around now. She is a teacher in the same building here, so it's looking like we're here for the long haul!

Anton Olbricht



I am currently teaching at Norris High School in Firth, Nebraska. This is my third year, and I am eagerly looking forward

to a year without a pandemic! I am currently teaching Biology and Earth Science. I will complete the requirements to receive my Natural Sciences endorsement this summer. For the Fall of 2022, I have accepted a position at LPS in the new Lincoln Northwest High School.

Spencer Powell



I am currently teaching AP Environmental Science as well as Outdoor Wilderness Leadership at Central

High School in Grand Junction, Colorado. After seven years teaching middle school, I have really enjoyed the chance to teach at the high-school level. One of the highlights of my job is taking students whitewater rafting down the Colorado River to conduct ongoing research on an invasive species monitoring project in partnership with the Bureau of Land Management and many other community partners. I love living in western Colorado with my wife and our dog, Murphy, who are both always up for adventures. We fly-fish, ski, hike, and mushroom hunt as much as we can.

See page 9 for more on Powell.

Travis Ray



I teach science and engineering at The Career Academy in Lincoln. It is a joint program between Lincoln Public Schools

(LPS) and Southeast Community College (SCC). I teach cohorts of juniors and seniors who are aspiring to pursue careers in engineering and related fields. My students are from the entire SCC region including all LPS high schools, Lincoln parochial schools, Waverly, and Palmyra, as well students who are homeschooled. I love teaching such a wide range of students who have similar academic and career goals. Most of my classes are college-level and dual-credit with SCC and include topics such as physics, engineering, robotics, computer programming, 3D printing, and manufacturing. Since graduating from Noyce, I have completed a MS in physics through Texas A&M University - Commerce. On a personal note, my wife and I welcomed our first child, a daughter, in February 2022.

Zach Schafer



I am currently a doctoral student at the University of Nebraska-Lincoln in science education. I am doing research

on restorative practices and studying uncertainty management in the science classroom. In November of 2021, Dr. Larry Scharmann and I published an article in The Science Teacher titled "Empowering Salieri: Extracting the Genius in Your Students."

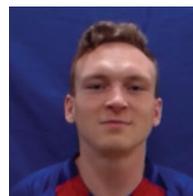
Jason States



I left my previous position as a science teacher at Lincoln High School. I now work for Bryan College of

Health Sciences as the director of the Medical Sciences Focus Program that will be housed at Lincoln Northwest High School starting in the fall of 2022.

Carter Svec



I am currently teaching 9th- and 10th-grade science at Lincoln Northeast High School. Additionally,

I started coaching with the Northeast basketball team.

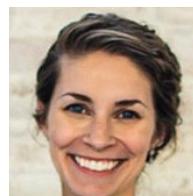
Miki Valenta



I am in my third year of teaching at Weeping Water Public Schools. I teach High School Health & Wellness,

Dietetics, Intro to Health Sciences, Child Development, 6th Grade Family & Consumer Sciences, Foods & Nutrition, and Culinary I. I am also the advisor for FCCLA and One Act.

Kristin Wiedel



I am currently a middle school science teacher in Kansas. I teach 6th-, 7th-, and 8th-grade science. I have loved being in

the same role for three years now and have been able to develop my own teaching style and lesson plans.

MAsT Program Graduates

2021-2022 Teaching Positions

(Nebraska unless otherwise noted)

The teachers identified below have completed the Master of Arts for science teaching program. Graduates who are no longer teaching have the year of their last known secondary teaching position listed.

Cohort 1

Robert Babani

AJ Benker, Fairfax County Public Schools, Madison High School, Virginia

Randy Crnkovich, Mount Michael Benedictine

Maggie Day, 2012-13, Millard Public Schools, Millard West High School

Caitlin Falcone, Lourdes Central Catholic

George Hill

Luciano Insua, Kearney Public Schools, Kearney High School

Sherri Joyner

Kelsey (Kumm) Nodgaard, 2020-21, Millard Public Schools, Millard West High School

Mia Manakul, Independence School District, Truman High School, Missouri

Cassie Manhart, Elkhorn Public Schools, Elkhorn South High School

Lanae Pierson, 2017-18, Columbus Public Schools, Columbus High School

David Primavera, Scottsdale Preparatory Academy, Arizona

Kate Sackett-Koll, Millard Public Schools, Central Middle School

Nate Van Meter, Louisville Public Schools, Louisville Middle School

Leah Zohner, Lincoln Pius X High School

Cohort 2

Heath Anderson, Sheldon Community School District, Sheldon High School, Iowa

Kristoff Berzins, Omaha Public Schools, Central High School

Vicky Boone, retired, 2020-21 Johnson County Central High School

Emily Brown, Morrill Hall Education Director, University of Nebraska-Lincoln; Henry Doorly Zoo School, 2019-20

Ayla Duba, 2019-20, Lincoln Public Schools, Lincoln Southwest High School

Jonathon Ismail

Matt Koziol, 2017-18, Greeley-Evans Weld County School District 6, Northridge High School, Colorado

Sara Laimans, Arrupe Jesuit High School, Colorado

Kim (Miller) Helzer, 2016-17, Centennial Public School, Centennial High School

Patrick Mumm, Deshler Public Schools

Kate Okerlund, 2015-16, Lincoln Public Schools, Lincoln Southeast High School

Michael O'Neal, Higley Unified School District, Higley High School, Arizona

Spencer Powell, Mesa County Valley School District No. 51, Central High School, Colorado

Chrissy (Ritta) Hecht, Bellevue Public Schools, Bellevue West High School

Katie Schueth, South Pasadena Unified School District, South Pasadena Middle School, California

Suzie (Wilson) Smith, Broken Bow Public Schools, Broken Bow High School

Cohort 3

Nikki Binderup, 2020-21, Lincoln Public Schools, North Star High School

Kay Burbach, Lincoln Public Schools, Lincoln Southwest High School

Katherine (Byers) Sporcic, 2018-19, Omaha Public Schools, Norris Middle School

Melissa Crabb, York Public Schools, York Middle School

Samantha (Davis) Lowery, Lincoln Public Schools, Lincoln Southeast High School

Eric Hanson, Lincoln Public Schools, Lincoln Southeast High School

Stephen Jacobson

Cory Johnson

Taylor Montgomery, Gering Public Schools, Gering High School

Brett Moser, Gering Public Schools, Gering High School

Joshua Trujillo, Cabarrus County Schools, Early College High School, North Carolina

Cohort 4

Mary Beth Bavitz

Tony DeGrand, D.C Everest Area School District, D.C. Everest Senior High School, Schofield, Wisconsin

LaTravia Dobson, Riverside Public Schools, Riverside High School

Victoria Freeman, Lincoln Public Schools, Lincoln High School

Jean Johnson

Tiara (Kush) Brown, Elkhorn Public Schools, Elkhorn High School

Travis Ray, Lincoln Public Schools, The Career Academy

Michael Schroeder, Westside Community Schools, Westside High School

Kristin (Strecker) Wiedel, St. Paul Catholic School, Kansas

Miki Valenta, Weeping Water Public Schools

Ethan van Winkle, Lincoln Public Schools, Lincoln Southeast High School

Cohort 5

Alia Aljamal

Sara (Al-shdifat) Zeid, 2019-20 Fairfax County Public Schools, Glasgow Middle School, Virginia

Blair (Kalinski) Burson, Gretna Public Schools

Peter Stone, Lincoln Public Schools, Lincoln Southwest High School

Cohort 6

Melanie (Blum) Burke, 2019-20, Omaha Public Schools, Omaha North High School

Zachary Burton, Gretna Public Schools, Gretna High School

Justin Elwonger, Geraldine Public Schools, Montana

Jamelyn Foster, 2020-21, Cedar Bluffs Public School

Katie (McMullen) Trotter, Lincoln Public Schools, Lincoln Northeast High School

Zachary Schafer, 2020-21, Lincoln Public Schools, The Lighthouse Program

Jason States, Lincoln Public Schools, Lincoln High School/ Northwest High School

Cohort 7

Lindsey Coit, Lincoln Public Schools, Lincoln High School

Dawn Eggert, Omaha Public Schools, OPS Multiple Pathways

Richard Eitel, Omaha Public Schools, Bryan High School

Andrew (AJ) Gebara, 2019-20, Gering Public Schools, Gering High School

Delfina Hernandez Perez, Lincoln Public Schools, North Star High School

Ashley Jadwin, Bellevue Public Schools, Bellevue West High School

Melanie (Kerr) Hueftle, Quest Academy Jr High, Utah

Breanne Lewis, 2018-19, Lincoln Public Schools, Culler Middle School

Keith Lloyd, North Platte Public Schools, North Platte High School

Ian Meador, Gretna Public Schools, Gretna High School

Kathryn Miller-Krivanek, Omaha Public Schools, Omaha Bryan High School

Kelby Phillips, Waverly Public Schools, Waverly High School

Cohort 8

Kevin Carpenter, The School District of Philadelphia, Lincoln High School, Pennsylvania

Peter Kosch, Kansas City Public Schools, Paseo Academy of Fine and Performing Arts, Missouri

Alex "AJ" McNeil, Lewiston Consolidated Schools, Lewiston Jr/Sr High School

Emmaline (Meyer) Baxter, Lincoln Public Schools, Culler Middle School

Alex Michalak, Omaha Public Schools, Bryan High School

Anton Olbricht, Norris School District 160, Norris High School

Carter Shank, Omaha Public Schools, King Science and Technology Magnet Middle School

Cohort 9

Jackson Fischer, Millard Public Schools, Central Middle School

Addison Krebs, Omaha Public Schools, Omaha North High School

Collin McAcy, Omaha Public Schools, Northwest High School

Cynthia Piepenbrink, Lincoln Public Schools, North Star High School

Amanda Studebaker, Omaha Public Schools, Northwest High School

Elizabeth Zurfluh, Omaha Public Schools, Central High School

Cohort 10

Ashley Bolton, Omaha Public Schools, Northwest High School

Mimi Harvey, Omaha Public Schools, Bryan High School

Taylor James, Columbus Public Schools, Columbus High School

Carter Svec, Lincoln Public Schools, Northeast High School

Jessica vonRentzell, Omaha Public Schools, Omaha Virtual School

Project Team

NOYCE PRINCIPAL INVESTIGATORS

Dr. Elizabeth Lewis, PI, is professor of science education in the University of Nebraska-Lincoln's Department of Teaching, Learning and Teacher Education. A former ninth-grade Earth and space science teacher and National Board Certified science teacher, Lewis coordinated the UNL MAsT program since its first cohort began in 2011 and has advised 60 of the 98 teachers in their MA programs.



Dr. Daniel Claes, co-PI, is professor and chair of the UNL Department of Physics and Astronomy. Claes, a former high school mathematics and physics instructor, is a high-energy physicist. As co-PI on the Noyce grant, he reviewed stipend applications for incoming MAsT students and served on faculty panels for MAsT capstone projects.



Dr. David Harwood, co-PI, professor, geologist, and micropaleontologist in the UNL Department of Earth and Atmospheric Sciences, has focused his research on climate change in the Antarctic and teaches a popular regional geology field course for geology majors and teachers of Earth and space science. As co-PI on the Noyce grant, he reviewed stipend applications for incoming MAsT students and served on faculty panels for MAsT capstone projects.



Dr. Tiffany Heng-Moss, co-PI, is dean of the College of Agricultural Sciences and Natural Resources and a professor in UNL's Department of Entomology. Her expertise includes developing interdisciplinary education projects and educational programs for undergraduate and graduate students and K-12 educators and students. As co-PI on the Noyce grant, she reviewed stipend applications for incoming MAsT students and served on faculty panels for MAsT capstone projects.



NOYCE TRACK 1, PHASE 2 GRADUATE RESEARCH ASSISTANTS

Ms. Elizabeth Hasseler, UNL doctoral candidate
Dr. Lyrica Lucas, UNL post-doc, School of Life Sciences

Dr. Ana Rivero, Seattle University, assistant professor

Dr. Amy Tankersley, science education curriculum specialist, Putnam City Schools, Oklahoma

Additional research team members:

Dr. Brandon Holding, UNL; Statistician, methodologist, and co-author

Dr. Aaron Musson, Omaha Public Schools, Nebraska; Collaborator and co-author

MAsT INSTRUCTORS

Many thanks to the following dedicated course instructors who have contributed to the success of the MAsT program.

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RMC, Dr. Emma Espel Villarreal

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Grace Kovar, UNL senior (Class of 2022), Journalism; Center for Science, Mathematics and Computer Education, photographer

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Tankersley, A., Hasseler, E., Lewis, E. B., & Lucas, L. (in preparation). *Teachers' use of NGSS Scientific Practices in Diverse Classrooms*.

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Rivero, A. & Lewis, E. (2020). Reflection and inquiry-based teaching: Exploring reflective practices in beginning secondary science teachers. In O. Levrini & G. Tasquier (Eds.), *Electronic Proceedings of the ESERA 2019 Conference*. The beauty and pleasure of understanding: Engaging with contemporary challenges through science education, Part 3, Strand 3 Science Teaching Processes (co-edited by S. Fechner & R. Verhoeff), pp. 320-329. Alma Mater Studiorum-University of Bologna. ISBN 978-88-945874-0-1.

Lucas, L. & Lewis, E. B. (2018). Modeling inquiry-oriented instruction of beginning secondary science teachers. In O. Finlayson, E. McLoughlin, S. Erduran, & P. Childs (Eds.). *Electronic Proceedings of the ESERA 2017*

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Lucas, L. (2019). Development of technology integration practices of beginning secondary science teachers: Analyzing gateways and barriers in the first five years (Unpublished doctoral dissertation). University of Nebraska-Lincoln.

Musson, A. (2018). Getting to the why: Exploring early-career physical science teachers' discourse and assessment practices (Unpublished doctoral dissertation). University of Nebraska-Lincoln.

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Implications for Science Teacher Certification Policy

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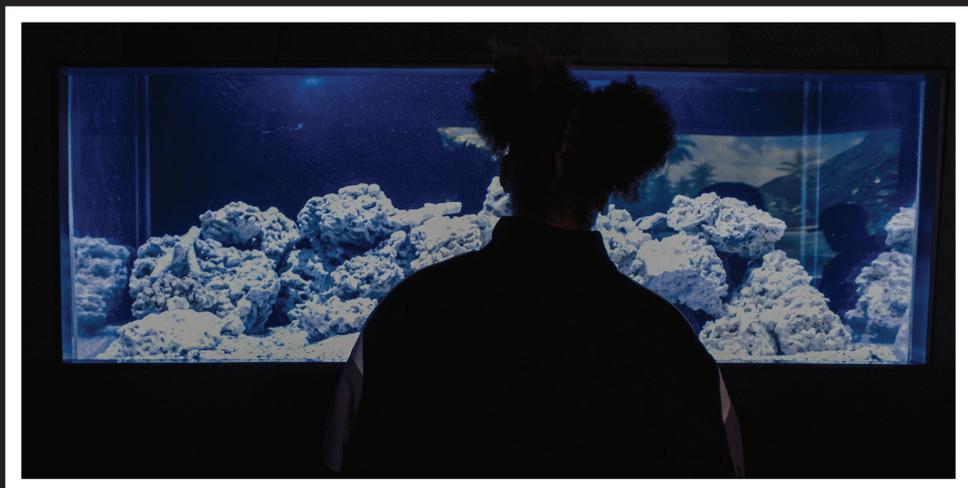
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An OPS King Science Zoo Career Program student visits the Henry Doorly Zoo's aquarium.

go.unl.edu/noyce-science-grants