UNIVERSITY OF NEBRASKA AT OMAHA

STEM Strategic Plan, Phase II: 2018–2023

Strategic Plan Overview

Since the initial launch of the STEM Priority at the University of Nebraska at Omaha (UNO) in 2012 the effort to advance science, technology, engineering, and mathematics (STEM) on our campus and in the region has been a collaborative journey among UNO students, staff, faculty, and administrators as well as our partners in the Omaha metropolitan community. It continues to be an increasingly interdisciplinary and inclusive process. In 2013, together with our colleagues both on and off campus, we developed a five-year STEM Strategic Plan that has served the campus well, providing the framework necessary to accomplish many of our foundational objectives. Encouraged and excited by our successes to date, we are now ready to build on the foundation of our Phase I efforts to implement Phase II: 2018–2023 and to move UNO STEM forward into a strong and sustainable future that we believe will be bright for our students and the community we serve. Many meetings, conversations, surveys, data, and projects have brought us to this point, and our collective mission continues with a refinement and renewal of purpose, as follows:

The mission of the UNO STEM Priority is to advance student understanding and success in the STEM disciplines, to support faculty collaboration and professional development in STEM research and education, and to aggressively lead community partnerships focused on increasing STEM capacity, competency, innovation, and literacy at all levels for the betterment of our metropolitan, regional, national, and international communities.

This purpose continues to be supported by four overarching goals focused on advancing STEM in the areas of *teaching and learning*, *research*, *community engagement/outreach*, and *infrastructure*. These goal areas align, respectively, with the four goals of UNO's Strategic Plan, which include *student centeredness*, *academic excellence*, *community engagement*, and *institutional quality*.

Remaining Objective from Phase I, Strategic Plan 2013-2018[1]:

To date, **31 of the total 32** objectives from the 2013 STEM Strategic Plan have been generally achieved. This remaining Phase I objective (previously Objective 4.1) had essentially two stretch elements, that seem particularly important to continue and to emphasize in Phase II:

- Plan, formalize and initiate a UNO-based STEM Center through 1) formal NU Board of Regent approval and 2) by identifying/building the infrastructure necessary to support STEM activities (i.e. facilities/building)
- Identify/build a facility/facilities to support STEM activities (to include building renovations and equipment)

These two remaining objectives will now become key elements within the next Phase II Plan, inclusive of detailed appendices summarizing our progress to date. These appendices include:

Summary of Return on Investment (ROI) to-date	Appendix A
Summary of UNO STEM Programs	Appendix B
Summary of STEM Degrees Awarded over past 8 years (Proxy for "Growth")	Appendix C
Gantt Chart for Next Steps on STEM Phase II at UNO	Appendix D
Center Concept Overview: Nebraska's STEM Teaching, Research, and Inquiry-based Learning Center (STEM TRAIL Center)	Appendix E

[1] https://www.unomaha.edu/college-of-education/office-of-stem-education/about/stem-strategic-plan.pdf

The Foundation of STEM Success to Date

In 2011, UNO was designated a Carnegie Doctoral/Research University in recognition of the University's evolution from being primarily a teaching institution to one that offers research doctoral degrees in a range of fields. Since then, the University has made a focused effort to support and expand research endeavors across campus. In the 2012 document, *UNO Campus Priorities: Charting a Clear Vision for 20/20*, "STEM" and "STEM Education" were identified as major initiatives within a campus-wide STEM Priority. Since then, a cohesive group of STEM Community Chairs, STEM department faculty, and STEM researchers have formed a very active and collaborative STEM Leadership Team, strongly supported by UNO administrators. This team, which has 57 members as of Spring 2018, has aggressively pursued external funding for STEM efforts and is proud to report that external grants led by members of the STEM Leadership Team now represent 30–40% of UNO's external funding in any given fiscal year. These grants help UNO faculty to expand existing and develop new innovative STEM initiatives, driving progress in STEM teaching, research, and outreach efforts across campus and in the wider community. As a consequence of these initiatives, faculty contributions to the scholarship of teaching and learning (SoTL) and discipline-based education research (DBER) continue to expand, elevating UNO's national status as a leader in providing and promoting effective P16 STEM education pathways from "cradle to career."

Collectively, over the last five years, UNO's existing STEM initiatives account for over $32 million in extramural funding within the State of Nebraska over the past five years and address all four overarching goal areas identified in the 2013 STEM Strategic Plan (i.e., teaching/learning, research, service/community engagement, STEM infrastructure). A detailed Return on Investment (ROI) Document is provided in Appendix A. Many individual STEM initiatives also combine teaching, research, and/or outreach activities, as illustrated in Figure 1. Further, we provide a brief sample of key accomplishments to date by goal area. Detailed summaries of "showcase" STEM initiatives, which collectively represent some of our best work to date, are provided in the attached STEM highlights document (Appendix B).

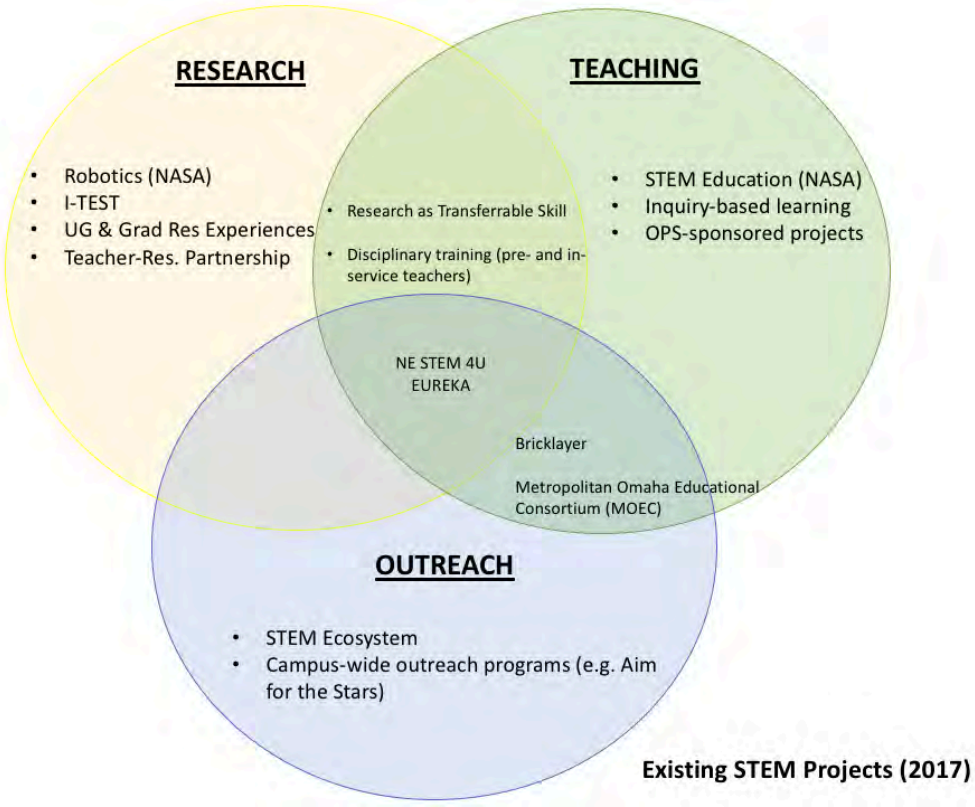


Figure 1. Existing STEM projects (from Phase I).

Teaching/Learning—Teams of UNO faculty have collaborated within and across departments and colleges, and with community partners, to create new opportunities in support of engaged, student-centered teaching and learning in the STEM disciplines at all levels of the P16 pipeline. Examples of new opportunities resulting from these collaborations include the following:

- Dual pathways for STEM disciplinary degrees and teacher certification.
- Increased integration of inquiry-based learning in undergraduate coursework (e.g., Calculus, Biology, Engineering).
- Team-taught interdisciplinary courses focused on workforce development (e.g., Inquiry Learning in STEM at Glacier Creek)
- STEM-focused student support services (e.g., mentoring through NE STEM 4U, Learning Assistants at the undergraduate and graduate level for science coursework, Anatomy Academic Assistants, and Near-Peer Tutors at the Health & Careers Resources Center).
- Disciplinary professional development opportunities and scholarships for pre-service teachers (e.g., NoyceMATH, NoyceSCIENCE).
- New STEM programs in Computer Science (Supplemental Teaching Endorsement, M.S. in CS Education)
- A shared STEM Prefix that helps to support interdisciplinary instruction and collaborative workloads
- Disciplinary training and ongoing education for in-service teachers (e.g., Teacher-Researcher Partnership Program).
- New P12 STEM projects sponsored by area school districts (e.g., P12 Comprehensive Teaching & Learning projects).

These efforts have been made possible by the support from a variety of grants and contracts awarded to UNO faculty in the Colleges of Arts and Sciences, Education, and Information Science & Technology, and Public Affairs and Community Service from national agencies (e.g., NSF, NASA, Department of Labor) and local foundations (e.g., Sherwood, Peter Kiewit Foundation), inclusive of STEM collaborations on grants with other NU campus as well.

Research—Interdisciplinary faculty teams have also collaborated on a number of STEM-related DBER projects and have created new opportunities to engage students in authentic research experiences in STEM. Examples include the following:

- Faculty teams have conducted several research projects investigating innovative STEM learning environments in areas such as educational robotics, computer science, wearable technologies, and biomechanics education (including funding by five different NSF I-TEST awards, NSF DRK12, NSF ATE, NSF EAGER and NASA).
- UNO is the lead institution for the national Network for Integrating Bioinformatics into Undergraduate Education (NIBLSE), an NSF-funded Research Coordination Network (RCN) for Undergraduate Biology Education focused on articulating a shared vision of the extent to which, and how best to, integrate bioinformatics into life sciences curricula.
- Faculty mentors provide research-based instructional interventions to cohorts of students in STEM-related student organizations (e.g., NE STEM 4U) and scholarship programs (e.g., NoyceMATH, NoyceSCIENCE). In addition, faculty mentors coordinate internship opportunities with local and regional industry and community partners.
- Faculty with active in-discipline research programs mentor undergraduate and graduate students in research (with support from UNO FUSE, NSF, NIH, and other extramural funds).

- Faculty also mentor in-service teachers in research through projects such as the Teacher-Researcher Partnership Program (funded by the Sherwood foundation).
- UNO faculty have contributed to the development of new online courses, such as Research as a Transferrable Skill (to be made available through the Oxford University Press on the Epigeum online course platform), and blended courses, such as Data Driven Decision Making, that is a common course for STEM graduate students across campus.
- STEM faculty regularly engage with students through journal clubs, directed reading or research activities.
- Faculty teams integrate research-based learning into innovative outreach initiatives designed to strengthen the P16 STEM pipeline (see Outreach/Community Engagement below).

These practices are all consistent with Kuh's High Impact Educational Practices (AAC&U), and they are contributing to increased student enrollment, retention, persistence, and completion in STEM (see Appendix C, STEM Progress Tables and Graphs). Furthermore, research-related STEM efforts are foundational to the 2018–2023 vision of designating a STEM Center (see timeline in Appendix D and concept/proposal for a STEM Center in Appendix E).

Service/Community Engagement—UNO has a long history of collaborating internally and with external partners to provide innovative STEM outreach activities, and in 2016, the UNO STEM Leadership Team and Omaha Citywide STEM Ecosystem received national recognition for their efforts, earning UNO an exemplary designation for the W.K. Kellogg Foundation's Community Engagement Scholarship Award. Examples of the types of activities for which UNO was recognized include the following:

- UNO STEM, along with the Henry Doorly Zoo and Aquarium and other city organizations, is a key founding partner for the Omaha Citywide STEM Ecosystem, which represents partners across education, business, industry, and non-profit sectors who share a vision to maximize STEM learning initiatives in the Greater Omaha area from "cradle to career."
- UNO STEM offers a wide variety of innovative educational programming to strengthen and expand the K12 STEM pipeline, including afterschool programs (e.g., NE STEM 4U), on-campus events and summer camps (e.g., Code Crush, Chemistry Field Day, EUREKA, Aim for the Stars), and educational software and online learning tools (e.g., Bricklayer). Such efforts are supported with funding from local, regional, and national organizations (e.g., Sherwood Foundation, Peter Kiewit Foundation, Nebraska Department of Education, NSF, and school districts within the Metropolitan Omaha Education Consortium).

Infrastructure—Over the last five years, UNO has recruited and supported a STEM Leadership Team, now numbering 57 members, using an innovative and effective community chair model, who work closely with College Deans and Department Chairs. This cross-college interdisciplinary leadership team has collaboratively with many STEM colleagues and has established a productive record of program development, extramural funding, and educational best practices that has radiated through academic units across campus and into partner organizations across the Omaha metropolitan area. Building on this foundation, UNO is prepared to move to the next level (Phase II) in propagating successful models in STEM education.

The 2018–2023 STEM Vision, Goals, and Objectives

The vision of this Phase II STEM Strategic Plan for 2018–2023 is to further strengthen and expand UNO's STEM infrastructure to support continued innovation and growth in STEM teaching, research, and outreach and to elevate UNO and the State of Nebraska to exemplary status in STEM, regionally and nationally.

Going forward, the focus of our four overarching goals will remain the same as in the previous plan. We will continue to pursue innovative initiatives to advance STEM teaching and learning (Goal 1), research (Goal 2), and service/community engagement (Goal 3), with many initiatives addressing more than one area (Figure 2). At the same

time, our objectives in all goal areas will be designed to strengthen and expand UNO's STEM infrastructure (Goal 4) in support of a new STEM Center of Excellence. Specifically, the UNO STEM Leadership Team believes continued progress requires the organizational structure and funding possibilities of a designated STEM Center. Establishing such a Center will help launch a new trajectory, allowing UNO to recruit additional personnel and providing the operational infrastructure that can also advocate for and help to plan the physical resources necessary to capitalize on existing synergistic STEM initiatives across the region. The needs, demands, and opportunities associated with establishing such a Center are articulated in a separate conceptual proposal for a new STEM Teaching, Research and Inquiry-based Learning (STEM TRAIL) Center (provided here as Appendix E).

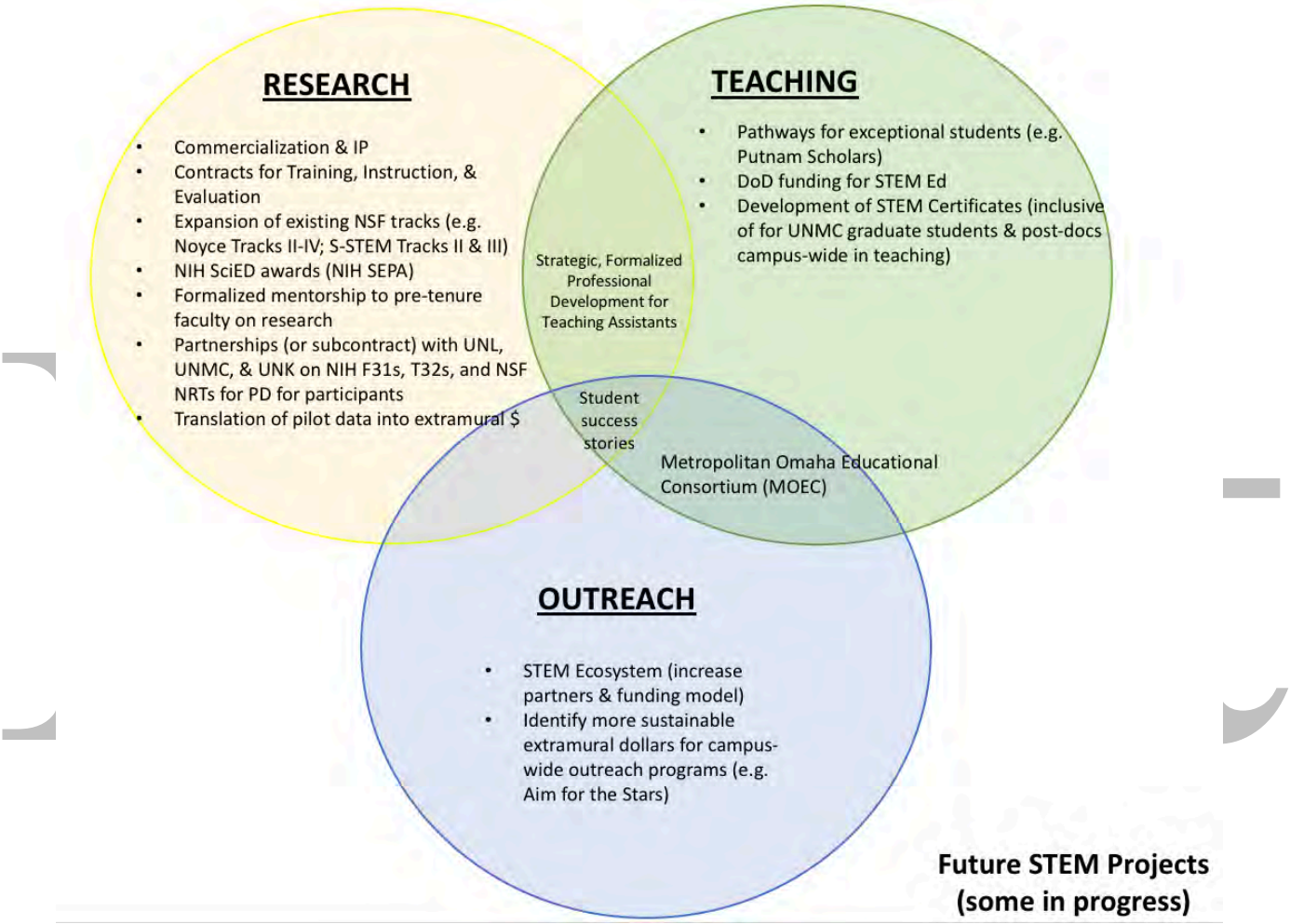


Figure 2. Future STEM projects (some are already in progress at time of writing Phase II).

The following objectives, organized by goal, represent the greatest future potential for further operationalizing and expanding the STEM priority on campus as conceptualized by the STEM Leadership Team. In the context of continued interdisciplinary conversation and collaboration, we seek to aggressively build on our strong foundation to increase the return on investment for STEM initiatives and retrieve additional external funding dollars, striving for more than $90M over the next 5 years. It is important to note that, given the national STEM landscape at this particular time, UNO's strong record of success in STEM, a strong base of metropolitan partnerships and the growing array of external funding opportunities increasingly available in STEM, we collectively see these "stretch" objectives as both appropriate and feasible.

GOAL 1: TEACHING/LEARNING *To strengthen the P16 STEM educational pipeline through innovative and interdisciplinary UNO STEM learning initiatives and to thus increase interest, involvement, and success in the STEM disciplines among all UNO students, especially those from underrepresented groups.*

- To continue to build interdisciplinary synergy and STEM pathways to welcome all students into STEM, with a new and special attention provided to exceptional students, while recruiting, retaining, and graduating an increased number and diversity of STEM students at UNO.
- To build a strategic professional development initiative that formalizes STEM instructional training for teaching assistants across STEM departments and colleges and that offers contractual services in STEM professional development to other universities and partners.
- To further expand the use of the STEM prefix as a catalyst to developing and offering innovative, interdisciplinary STEM coursework at both the graduate and undergraduate levels.
- To create interdisciplinary STEM courses, in areas such as high-altitude ballooning, that increasingly draw students into STEM educational pathways and future careers and that provide mechanisms for further innovative STEM experiences, such as participation in NASA's national CubeSat program or NASA- and NSF-related internships.
- To develop STEM graduate certificates, inclusive of Teaching Proficiency Certificates at the graduate level for UNO, University of Nebraska Medical Center (UNMC), University of Nebraska-Lincoln (UNL) and the University of Nebraska at Kearney (UNK) for graduate students and post-docs.
- To help to support faculty training in innovative STEM pedagogies, with special attention to student research experiences, inquiry-based learning, and project-based learning.
- To expand the use of innovative STEM spaces for student learning and experiences, both on campus (such as courses at Glacier Creek), and off campus (such as in STEM internships in businesses and community collaborators) and in partnership locations such as at the Omaha Henry Doorly Zoo and Aquarium.
- To work closely with the Metropolitan Omaha Education Consortium to further develop and to refine well-articulated P16 pathways into UNO STEM programs.

GOAL 2: RESEARCH *To become a national leader in the research, development, and refinement of STEM active learning models that particularly support student success in metropolitan settings across the P16 pipeline and into STEM careers.*

- To further expand external funding for STEM initiatives.
- To establish a focused research commercialization and intellectual property effort for STEM initiatives (inclusive of patents on assessments, curriculum, process, product, and training programs).
- To educate faculty and to explore new funding opportunities for STEM educational programs, including opportunities through the Department of Education, Department of Labor, and Department of Defense.
- To work closely with the University of Nebraska Foundation to help to identify and to apply for "seed funding" for important STEM Initiatives, such as is possible with the Gates Foundation.
- To expand financial support for students in STEM disciplinary and STEM education pathways, including winning further external scholarship grants by focusing on related funding tracks in NSF, which considers such projects as STEM research intensive endeavors (Noyce Tracks II–IV and S-STEM Tracks II & IV).
- To serve as key partners for NSF Research Traineeship (NRT) awards with UNMC, UNL, or Metropolitan Community College (MCC), including partnering in specialized cross-institutional funding programs (such as the NSF Advanced Technical Education program for community colleges and university collaborations).

- To partner with UNMC, UNL (especially Engineering and Social Sciences), UNK, MCC, and Iowa Western Community College (IWCC) faculty to serve as the "Teaching Training or STEM Partner" for various initiatives, particularly for NIH and NSF research training grants for graduate students and post-doctoral fellows (e.g. NIH F31 and T32 awards).

GOAL 3: SERVICE/COMMUNITY ENGAGEMENT *To foster innovation in STEM service and community engagement in STEM learning through active, synergistic, and sustainable partnerships with the broader STEM community, including STEM educators, business professionals, and informal education partners.*

- To further expand and strengthen the Omaha Citywide STEM Ecosystem, as a mechanism for shared growth in STEM "cradle to career" educational pathways in the city, with a focus on educational initiatives that integrate services and resources of partners across sectors, including those in formal education, informal education, business/industry, government, and community.
- To continue to partner aggressively with the Metropolitan Omaha Educational Consortium in STEM-related school-district empowerment initiatives and particularly seek P16 external funding opportunities, such as for collaborative after-school programs, summer enrichment, and STEM event opportunities for youth.
- To expand ongoing STEM outreach efforts, with a special priority on efforts that build the P16 STEM pipeline and UNO enrollment in STEM programs (including the incorporation of more partners).
- To expand UNO Citizen Science collaborations, that involve P16 students in collaborative research projects that directly serve the community (for example BioBlitz).

GOAL 4: STEM INFRASTRUCTURE *To provide administrative leadership and support through a UNO STEM Teaching, Research, and Inquiry-based Learning Center to ensure continued growth and excellence in UNO STEM-related teaching, research, and service initiatives.*

- To establish a formalized UNO STEM TRAIL Center that includes focused organizational procedures, dedicated personnel and state-of-the-art facilities to facilitate efficient interdisciplinary collaboration across colleges and departments and that will be a powerful catalyst to shared success across all campus units (see STEM TRAIL Center proposal for details).
- To leverage the expertise represented by UNO STEM to provide contractual services locally, regionally, and nationally for STEM-related training, professional development, instruction, or evaluation projects, thereby generating revenue and the increasing national visibility of UNO STEM.
- To establish the infrastructure mechanisms for STEM Service Cost Centers with the UNO STEM community to help colleges and departments more efficiently manage and support interdisciplinary STEM efforts.
- To increasingly work with the NU Foundation to showcase pilot STEM initiatives and studies at UNO and to transition successful pilot projects into sustainable, externally funded, national models of effective STEM programming.
- To seek opportunities to build initiatives that include traditionally non-STEM disciplines, such as in the Fine Arts and Music, as a source of STEM innovation, creativity, and collaboration for STEAM initiatives (STEM+Art) and to increasingly draw upon the significant expertise of faculty with strong STEM skill sets across all of UNO, such Economics or Entrepreneurship.
- To work closely with University Communications to publicize success stories of our STEM students (e.g., Putnam Scholars, Noyce Scholars, NIH and NSF grant recipients) as a strategy for recruiting more students, attracting donors for scholarship funds, and increasing externally funded scholarship awards.
- To work closely with the STEM deans, the Associate Vice Chancellor for Research and Creative Activity, and others as needed to collaboratively build innovative and interdisciplinary faculty workload strategies,

mentoring and policies to support increased grant funding competitiveness for individual investigators (e.g., address existing challenges associated with NSF's 2-month salary limitation).

Final Thought

This set of Phase II goals and objectives for the STEM Strategic Plan is purposefully more limited and more focused than our Phase I goals and objectives. More context is explained in the appendices, but one common thread is in all elements: collaboration. We hope to build upon, innovate, and find strength in our interdisciplinary and community collaboration. Everyone is welcome to contribute to STEM learning for all and we are committed to inclusion whether it be for the many students we have the honor to serve, or the many faculty, staff, administrators and community partners striving to serve them. A famous African Proverb states "that if you wish to go quickly, go alone, but if you wish to go far, then go together." In UNO STEM, and in this new Phase II effort, we certainly wish to go collectively and to go far. Since its initiation in 2012, the UNO STEM Priority has focused on breaking down silos, both within the traditional STEM disciplines and with partners in other disciplines that perhaps see themselves as non-STEM. We welcome them to the STEM table. To the STEM Leadership Team and the many UNO colleagues and partners working on this shared effort, silos of any type in learning and innovation are counterproductive and undesired, no matter their size. STEM is an inclusive campus priority, that we hope that it will empower all students (both current and future) to achieve a brighter future and will support all faculty, staff, and community partners in helping those students to succeed.

UNIVERSITY OF NEBRASKA AT OMAHA

Appendix A

Summary of Return on Investment

Following is a summary of the return on investment (ROI) to UNO and the NU System for grant writing related to STEM research over the last five years (i.e., during implementation of the Phase I STEM Strategic Plan). It is from the collaborative portal of the STEM Community Chairs, including STEM research efforts that the Chairs helped to lead or to facilitate on behalf of the STEM Leadership Team, with acknowledgement and appreciation that the UNO/NU teams have involved many different departments, faculty colleagues, and Nebraska partners.

Five Years of Funded STEM Community Chair Grants (2012–2017)

Project Name	$ Amount	Timeframe
NSF SPIRIT and SPIRIT 2.0 CEENBot	$3.1 M	2008–2013
NSF Project SHINE	$1.1 M	2010–2012
NSF Integrating Bioinformatics into Life Sciences Education	$600K	2011–2014
NSF Research Experiences for Teachers Mobile	$500K	2012–2015
NSF IMPART Research Experiences	$449,000	2012
Girls, Inc. EUREKA!	$38,600	2012
NSF GearTec 21 Robotics: ITEST	$1.1 M	2013–2015
NSF GearTec Scale Up Robotics: ITEST	$2.3 M	2014–2019
NSF NE Math Omaha Noyce: Noyce	$1.1 M	2014–2019
NSF WearTec: ITEST Wearable Tech	$1.2 M	2015–2017
NSF SPARCS CS Ed: ITEST CS Teacher Workshops	$1.1	2015–2017
NSF Bioinformatics Ed: RCN	$499K	2015–2020
Girls, Inc. EUREKA!	$79,956	2015
NSF Research Exp Teachers CS:	$500K	2017–2019
NSF NEScience Noyce	$1.2 M	2017–2022
NSF Telepresence Robots in Ed: EAGER	$300K	2017–2018
NSF BODYMODELS: ITEST	$1.2 M	2018–2020
NSF EAGER NE Innovative Maker Co-Lab	$300,000	2017
NE Department of Labor NE's IT Educational Pathway	$9,162,680	2014–2018
NE Online Worldwide CSE	$35,000	2013–2016
Sherwood Foundation CSE for In-service Teachers	$97,769	2016–2019
NSF EXP RUI	$448,698	2013–2017
NSF CER	$442,301	2013–2016
Google CS4HS@UNO	$35,000	2014
NSF RCN-UBE NIBLSE	$49,890	2014
Girls, Inc. EUREKA! STEM	$80,000	2016, 2017
Sherwood Foundation K-12 Comprehensive Science	$4.2M	2014–2018
Sherwood Foundation TRPP	$628,208	2015–2018
Sherwood Foundation NE STEM 4U	$381,941	2012–2018
Peter Kiewit Foundation NE STEM 4U	$62,664	2015–2018
NSF RCN-UBE	$499,937	2015–2019
USDE NE SciLEAD	$15,000	2017–2018
Total awarded $32,886,644 – ($203,500 CC endowment + grant writers) = ROI = $32,683,144		

NOTE: **ROI Calculation = [(Total extramural grant funding, not inclusive of contracts nor indirect costs from the 3 STEM Community Chairs (i.e., in Teacher Education, Computer Science, and Science) from 2012–2017 less the cost of the Community Chair annual endowment)].** The research and service time of Community Chairs is not included as such time is part of their 9-month faculty appointment within departmental units (i.e., 25–50% research assignment). The totals are less the Community Chair yearly endowment and the University-supported resources for a given project (if provided, e.g., funding for a grant writer if matched from a UNO source). Only funds obtained, not inclusive of submitted but not successful proposals, are included. The ROI excludes contracts and in-kind work (above workload) that has led to additional significant cost savings to the university for items purchased from vendors (e.g., FlowJo, Epigeum, amongst others).

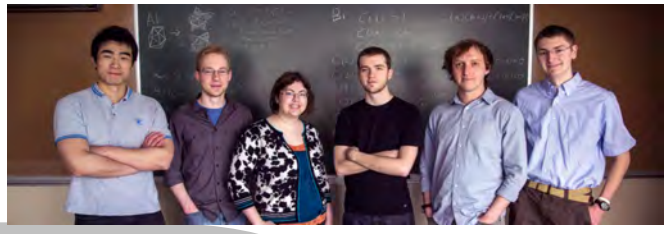
Appendix B

A Glimpse of UNO STEM Programs

UNO has numerous showcase STEM programs underway representing growth, innovation and collaboration in STEM teaching, research, and outreach.

The UNO Putnam Scholars

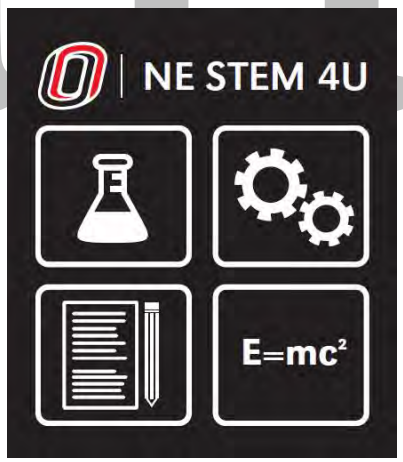
Led by senior faculty in the UNO Mathematics Department, UNO teams frequently place highly on the prestigious Putnam Competition, held annually for the top undergraduate mathematics students in the U.S. and Canada. The competition began officially in 1938 but has origins as far back as 1933 when 10 students from Harvard competed against 10 students from the United States Military Academy at West Point. The competition consists of two, three-hour sessions of six math problems, which are graded on a scale of 0-10 points. Competitors must show the steps in their work to justify an answer and receive full credit, and partial credit may be given only when showing significant progress towards the solution. Sponsored by the Mathematical Association of America, the competition has counted many distinguished mathematicians and scientists among its participants over the years, including Nobel Prize winner John Nash, noted for his work in game theory and differential equations and the subject of the 2001 Hollywood film "A Beautiful Mind." UNO teams routinely do quite well in this most competitive of university mathematics competitions. For example, UNO's 2013 Putnam team placed 49th out of 557 competing institutions from across the United States and Canada, good enough to be among the top 10 percent of participating North American schools.



https://www.unomaha.edu/news/2014/04/putnam.php

NE STEM 4U

NE STEM 4U is a student-run organization at the University of Nebraska that is committed to bringing quality, afterschool STEM activities to disadvantaged elementary and middle school students in the Omaha Public Schools and Kearney Public Schools districts. At the same time, NE STEM 4U engages undergraduate students in meaningful pre-professional practices, including teaching, research, and mentoring. With support from faculty and peer mentors, undergraduates provide twice-weekly, inquiry-based learning activities to engage the next generation of scientists in asking questions, making observations, and honing their skills and tenacity as scientists. In addition, undergraduates assist faculty in collecting and analyzing data about the program, thus contributing to discipline-based education research. Data collected on the program since 2013 indicate that NE STEM 4U is indeed positively impacting student learning across the K16 pipeline, and researchers continue to investigate the program as a model for effectively recruiting, retaining, and graduating students from disadvantaged backgrounds in the STEM disciplines and for providing them with the support they need to succeed in the STEM workforce.



http://nebraskaomaha.orgsync.com/org/nestem4u

Mathematical and Computational Thinking with Bricklayer

Bricklayer is an open-source, online educational ecosystem developed at UNO that uses coding, mathematics, and visual art to teach computational, quantitative, and visual-spatial skills. The mathematical and computational thinking group—an interdisciplinary team of UNO faculty from computer science, mathematics, and teacher education—uses Bricklayer to engage students across the K-16 pipeline in learning math and computer science. In August 2017, the group was awarded a two-year $300,000 National Science Foundation grant to create, teach, and evaluate a new Bricklayer-based course to satisfy the UNO general education math requirement. The course, MATH 1120: Introduction to Mathematical and Computational Thinking, was offered for the first time in Spring 2017. This group also has worked with more than 75 schools in the Omaha metropolitan area to train teachers to teach mathematical thinking, computational thinking, and coding. Research conducted with OPS teachers of gifted 4th and 5th graders showed that after a 10-week unit of a Bricklayer curriculum, students improved significantly in certain mathematical skills, including visual-spatial reasoning and coordinate graphing.

https://www.unomaha.edu/college-of-arts-and-sciences/news/2017/08/bricklayer-grant.php

Teacher-Researcher Partnership Program

The Teacher-Researcher Partnership Program is a partnership between UNO and the Omaha Public Schools that provides summer research experiences for in-service teachers. Teachers are paired with science research faculty to conduct genuine research projects during the summer months. Teachers also participate in weekly journal clubs and present their work in a live poster session at the end of the summer, which provides them with opportunities to evaluate current research, develop collaborative relationships, and broaden the scope of their research experience beyond a single project.

https://www.unomaha.edu/college-of-arts-and-sciences/teacher-researcher-partnership-program/research-pubs/index.php

Innovative Computer Science Education for Teachers

UNO is a state, national and international leader for Computer Science Education, addressing a growing and critical national need, and has had numerous initiatives led by the Computer Science faculty in close collaboration with Teacher Education

faculty. Programmatic innovations include one of the first in the U.S. Supplemental Endorsements for Computer Science Education (undergraduate and graduate options), as well as a Master of Science Degree in Computer Science Education. Numerous graduate courses that focus on Computer Science Education, in a variety of convenient instructional formats, are being offered. In addition, collaborating faculty have received numerous grants for "deep dives" into computer science education for area teachers, including grants from the National Science Foundation for the Innovative Experiences for Teachers and Students (ITEST) program and the Research Experiences for Teachers (RET) program. Faculty have also received NSF funding for Research Experiences for Undergraduates (REU), which often involve elements of innovative STEM instruction. Other foundation and external grants have been funded, with a track record of more than $3 million of external funding for computer science education to date. UNO also sponsors Nebraska's local Computer Science Teachers Association chapter and supports and promotes the teaching of computer science and other computing disciplines.

https://www.unomaha.edu/college-of-information-science-and-technology/computer-science-education/index.php

NebraskaMATH and NebraskaSCIENCE Omaha Noyce Partnerships

The National Science Foundation's Robert Noyce Teacher Scholarship Program seeks to encourage talented STEM majors and professionals to become K-12 mathematics and science (including engineering and computer science) teachers. The program supports creative and innovative projects that address the critical need for recruiting and preparing highly effective elementary and secondary science and mathematics teachers in high-need local educational agencies. Thanks to a strong foundation of collaboration between UNO and local school districts, including the Omaha Public Schools, the university has received Noyce awards for two such projects—the NebraskaMATH and NebraskaSCIENCE Omaha Noyce Partnerships. These programs are designed to develop highly skilled secondary mathematics and science teachers who are committed to teaching in high need schools by providing targeted support for students enrolled in and graduating from UNO's undergraduate Bachelor of Science/Teacher Prep programs in Mathematics, Biology, Chemistry, Geography/Geology, and Physics. The NebraskaMATH and NebraskaSCIENCE programs provide structured internships as well as financial, academic, and professional development support to prepare undergraduates for teaching.

https://www.unomaha.edu/college-of-arts-and-sciences/biology/community-engagement/noyce.php

WiSTEM Pro^2

WiSTEM Pro^2 is an organization on the UNO campus addressing the need for more women in STEM, while supporting those already in the field. **WiSTEM** stands for **Women in Science, Technology, Engineering and Mathematics**. **Pro2** represents the **PROmotion** and **PROfessional development** goals of the organization. Although women make up more than half of the total U.S. population and the college-educated workforce, they represent only about a quarter of the STEM workforce. Of women employed as full professors in STEM in academic institutions, they hold approximately 25 percent of senior faculty positions.

Overall, they are paid less and are less satisfied with their sense of belonging in their departments as compared to their male counterparts. UNO's WiSTEM Pro^2 serves as a coordinating hub for the existing network of UNO and community resources related to supporting women in STEM. It is open to anyone at UNO, regardless of gender, committed to advancing career and leadership opportunities for women in STEM. Current members represent diverse areas across campus, including traditional STEM disciplines as well as emergency management, gender studies, counseling, and music.

https://www.unomaha.edu/wistem-professional-development/index.php

Project HALON

Project HALON (High Altitude Learning Over Nebraska) is a collaborative STEM outreach project facilitated by UNO, the University of Nebraska-Lincoln (UNL), the Peter Kiewit Institute, NASA Nebraska Space Grant, Omaha Public Schools, and other partners. Designed to engage high school and college students in hands-on STEM experiences, the project uses high altitude balloons to launch student experiments into near space to gather scientific data. Undergraduate student researchers and faculty mentors work with teams of high school students from the local area to create experimental research packages that are lifted to the edge of space. During the process, the undergraduate students and faculty mentors help the high school teams learn the fundamentals of NASA's space systems engineering process as they propose an experiment, design sensors, and build, test, and fly their experiment on Project HALON's flights.

NASA Space Grant and EPSCoR Funding at UNO

UNO is home to the NASA Nebraska Space Grant office, which represents a consortium of higher education institutions, government affiliates, and community partners across the state. The office coordinates state funding for the NASA Space Grant and the Experimental Program to Stimulate Competitive Research (EPSCoR) programs, which are focused on promoting and funding aerospace-related research and education within Nebraska. Each year, nearly 150 students and 20 to 30 researchers across the state are awarded support for projects focused on a diverse range of research topics, including biomechanics, 3D printing, computer science, Earth science, STEM outreach, and microgravity experiments flown to the International Space Station (ISS), among others. UNO enjoys strong research support from Space Grant and EPSCoR funding, as numerous student and faculty researchers receive fellowships and mini-grants each year. Awards are made through a competitive annual process. In addition, the office serves as a key organizational mechanism for UNO STEM engagement in NASA opportunities, such as monitoring the 2017 Solar Eclipse as part of a NASA-coordinated national high-altitude ballooning effort. The Space Grant office is housed within the UNO College of Public Affairs and Community Service.

https://ne.spacegrant.org/

The Omaha Citywide STEM Ecosystem

UNO, along with the Henry Doorly Zoo and Aquarium and other Omaha organizations, is a key founding partner for the Omaha Citywide STEM Ecosystem, which represents partners across education, business, industry, and non-profit sectors who share a vision to maximize STEM learning and workforce development initiatives in the Greater Omaha area from "cradle to career." This innovative organization was founded in 2016 and is one of just 54 citywide STEM Ecosystems in the U.S. as recognized by the national STEM Funders Network, and one of just a handful that have a full time Director. More than 80 different organizations collaborate for STEM initiatives, which are led by a highly engaged Steering Committee and five Working Committees, involving 70+ organizational representatives in shared initiatives. More than 500 different organizational representatives have attended STEM Ecosystem planned events and activities.

http://omahastem.com/

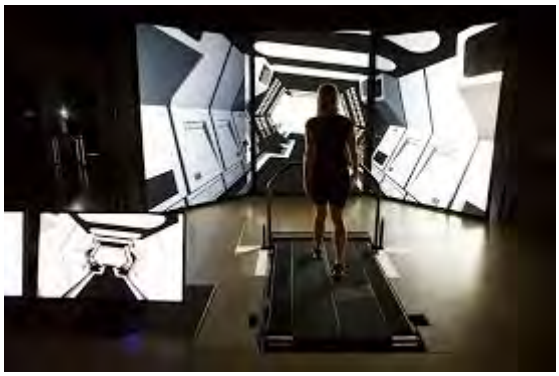
Innovative Information Technology P12 Outreach Programs

The U.S. Bureau of Labor Statistics predicts that information technology will be one of the fastest-growing job sectors, adding nearly 1.4 million jobs by 2020. However, nearly two-thirds of these jobs could go unfilled because there are not enough college graduates with computing-related degrees. In response to this need, UNO's College of Information Science & Technology offers several innovative outreach programs designed to engage more P12 students in IT. Examples include Techacademy, iSTEM and CodeCrush.

Techademy is a series of week-long summer camps for students in grades 5–10. Every camp is designed to show students the fun in IT, while helping them to learn new concepts, tools, and skills. The camps are taught by current IS&T students on topics such as cybersecurity, mobile app development, and many others, providing students a glimpse into what a career in IT really is. During the school year, IS&T students take Techacademy activities into the schools through the iSTEM out-of-school-time program. In iSTEM, middle and high school students are introduced to topics like Scratch programming and App Inventor through hands-on activities where students can make cool stuff and practice on their own time. iSTEM programs run the duration of the school year at participating schools. IS&T also offers programs to attract more girls to IT, including CodeCrush, which is a series of iSTEM immersion experiences for 8th and 9th grade girls and their teachers designed to inspire girls and their teachers to take a deeper look at IT through hands-on experiences with emerging IT fields such as bioinformatics, IT innovation, music technology, and cybersecurity.

https://www.unomaha.edu/college-of-information-science-and-technology/engagement/p-12-school-initiatives.php; https://www.unomaha.edu/college-of-information-science-and-technology/techademy/index.php; https://codecrush.unomaha.edu/

STEM and Biomechanics



UNO STEM has a strong relationship with the internationally-renowned researchers in the UNO Department of Biomechanics, which participates in numerous STEM initiatives both on campus and in the community. Biomechanics is, fundamentally, the study motion—the forces that act on a body and the effects they produce. It involves the intersection of biology, physiology, anatomy, physics, mathematics, and chemistry, and includes a focus on improving quality of life by solving difficult problems in medicine and health. The Department of Biomechanics, within the UNO College of Education, houses the 23,000-square-foot Biomechanics Research Building (BRB), which serves not only UNO but also the entire University of Nebraska system and the state of Nebraska by educating and developing a dynamic workforce and by enhancing economic growth through development of biotechnology and biomechanical intellectual property. The BRB houses state-of-the-art laboratories that include Main Motion Capture, Virtual Reality, Acoustics, Balance and Strength, Motor Development, and Robotics. Working with other UNO STEM faculty, Biomechanics researchers and staff offer numerous STEM engagement opportunities for area schools, including field trips and large-scale events, such as National Biomechanics Day.

https://www.unomaha.edu/college-of-education/biomechanics-core-facility/about-us/index.php

Eureka!

The Eureka! program is a STEM education partnership between UNO and Girls Inc. of Omaha that is designed to encourage young women to pursue careers in which women, and especially women of color, are severely underrepresented. Formed in 2012, Eureka! provides girls with a five-year STEM program that begins the summer before they enter the eighth grade and supports them until they graduate high school. The first Eureka! cohort graduated in May 2017, and almost all of the young women in that cohort are now pursuing a college education in a STEM-associated field. Experiences for both the veteran and rookie groups of girls include lessons on topics like computer programming, chemistry, bioinformatics, engineering, and geology. Guidance and lessons on STEM concepts are provided by faculty from STEM departments across UNO. Participants have opportunities to apply their new STEM skills at locations such as Adventureland, Omaha's Henry Doorly Zoo and Aquarium, and UNO's Rosken's Hall and Glacier Creek Preserve. Participants also engage in interesting hands-on STEM activities, such as launching a high-altitude balloon, programming CEENBoT robots, and using the equipment at the UNO Biomechanics Research Building. In addition, participants receive physical education lessons, including swimming lessons, from Campus Recreation staff.

https://www.unomaha.edu/college-of-education/news/2017/07/eureka-stem-is-five-years-strong.php

Aim for the Stars

Aim for the Stars (AFTS) is an interdisciplinary outreach program in which UNO students, faculty, and staff from across the STEM disciplines actively collaborate with each other and with community partners, including informal education partners and Omaha-area teachers, to provide innovative, fun, hands-on STEM learning to Omaha-area youth in week-long summer camps. The AFTS camps are held at UNO, allowing students from throughout Omaha to become familiar with the UNO campus. Curriculum for the AFTS camps is based on current, standards-based, science and mathematics, and it uses inspiring hands-on activities to engage students in learning. Since the program's inception in 1998, the number of AFTS camps offered and the number of students served has continued to grow, and AFTS camps now enroll approximately 1,800 youth each summer (Fig 1).

https://www.unomaha.edu/college-of-arts-and-sciences/aim-for-the-stars/index.php

STEM Dual Pathways for Teacher Certification

UNO STEM is working to contribute to the national need for strongly qualified high school STEM teachers. In an effort to synergize efforts across colleges and to support undergraduates pursuing an interest in STEM teaching, students can get a disciplinary major (and often a double degree) in the STEM areas of Mathematics, Physics, Chemistry, and Biology. Students can also work toward a supplemental endorsement in Computer Science. Work is also underway in other disciplines such as Geology/Geography. Both undergraduate and graduate coursework options are possible. The strong STEM content and pedagogy coursework available to UNO students, allow students to be "highly qualified" when entering the high school teaching career, and to be able to more work more easily toward Masters Degree work in the Colleges of Education, Arts and Sciences, and Information Science and Technology, which then allows them to eventually teach dual enrollment courses. Students are typically awarded a degree in the STEM discipline with teaching certification and usually, also a degree in education, to allow them to begin teaching in a "deep" way (i.e. strong command of a single subject matter) with highly effective instructional pedagogy learned in the College of Education. These efforts have been further supported through a $2.4 million in student scholarship grants shared across colleges from the NSF's Noyce Science program that are supporting up to 80 pre-service STEM teachers to enter high needs schools upon graduation. Interested students should contact the advising office in the College of Education or their respective college. The STEM collaborations have also led to some Non-STEM Dual Pathways options, such as in English, so students should be sure to ask about options in their UNO colleges.

https://www.unomaha.edu/college-of-education/student-services/academics/index.php

STEM and Aviation

The Aviation Institute in the UNO College of Public Affairs and Community Service (CPACS) facilitates many STEM programs and community collaboration efforts related to flight. Since its

inception in 1990, the institute has soared to great heights, offering students flight instruction and education in the many other facets of aviation, such as air traffic control, airport management, ground operations, and security. Three on-site flight simulators located within the CPACS building are a must-see for every campus tour. These flight simulators are also frequently used as a STEM showcase and participation location for community outreach efforts, such as during the Nebraska Science Festival events on campus. New programs, such as drone training workshops, are also closely connected to numerous STEM efforts across the campus and state.

https://www.unomaha.edu/college-of-public-affairs-and-community-service/aviation/index.php

STEM at Glacier Creek

Glacier Creek Preserve, facilitated by the UNO Biology Department and College of Arts and Sciences, is a UNO instructional environment that includes a 172 ha (424 acre) preserve situated northwest of Omaha in the rolling hills of eastern Nebraska. Embedded within the preserve is the 57 ha (140 acres) Allwine Prairie Tract, a restored tallgrass prairie created in 1970. The preserve has a diversity of functioning plant and animal communities and incorporates an entire sub-watershed. This feature protects the preserve against effects of surrounding land use, thus reinforcing its sustainability into the foreseeable future as a unique metropolitan-area preserve available for education, research, and appreciation of our natural heritage. The preserve offers numerous student research opportunities, as mentored by UNO STEM faculty and various STEM courses and as facilitated by UNO STEM faculty and the Hubbard STEM Learning Instructor. The preserve is also home to a modern laboratory facility within the context of a renovated barn, and it has a full-time outreach director who works closely with Omaha area schools and the community.

https://www.unomaha.edu/college-of-arts-and-sciences/nature-preserves/

Chemistry and Physics on Wheels (CAPOW)

An innovative program facilitated by the Physics and Chemistry Departments in the UNO College of Arts and Sciences is the Chemistry and Physics on Wheels or "CAPOW" program. Well known across the city and state, the CAPOW vans take UNO faculty and students on the road to facilitate community events in science, offering exciting overviews of physics, chemistry, and/or energy resources. The CAPOW vans can also be seen frequently at Omaha-area events.

https://www.unomaha.edu/college-of-arts-and-sciences/chemistry/community-engagement/capow.php

The Nebraska Robotics Expo

The Department of Teacher Education (UNO) collaborates closely with the UNL Electronics Engineering Department, the UNL 4H Extension Office, and other Nebraska collaborators, such as the Strategic Air Command & Aerospace Museum in Ashland, to host the annual Nebraska Robotics

Expo. This event draws 4,000 students, teachers, community collaborators, and exhibitors who help Nebraska schools to participate in innovative robotics competitions and student involvement activities. Numerous UNO STEM partners across the city and state have participated in more than 10 years of annual events, which also include a robotics art showcase. The event has been highlighted by the Nebraska Loves Public Schools organization, along with other city, state, and national media organizations.

http://nelovesps.org/story/robots-take-over-the-classroom/

Chemistry Field Day

For more than 30 years, the UNO Chemistry Department has sponsored Chemistry Field Day, which brings numerous students and teachers from area schools to campus to participate in hands-on chemistry activities.

In addition to this "high-energy" STEM event, the Chemistry department also hosts numerous field trips, visits, and workshops with area STEM groups, such as the Girl Scouts. These events and field trips help young people to get excited about chemistry as a discipline and STEM as an educational direction. Faculty in Chemistry's innovative Community of Practice also participate in numerous other UNO STEM endeavors and host special training opportunities for high school teachers, such as Chemistry Advanced Placement workshops and courses.

https://www.unomaha.edu/college-of-arts-and-sciences/chemistry/community-engagement/field-day.php

The Metropolitan Omaha Education Consortium

UNO is the home base of the Metropolitan Omaha Education Consortium, which is a frequent collaborator and at times leader on P16 STEM Initiatives. Founded in 1988, MOEC is a model collaboration dedicated to public education. MOEC serves as a forum and community for education professionals and is a catalyst for identifying high-priority issues common to member organizations and addressing these issues through joint task forces and projects. The resulting synergy of ideas and resources makes MOEC a powerful force for improving education, including seeding STEM workforce development, in the metropolitan area public schools, community colleges and the university. In 2017, MOEC welcomed new partners and transitioned to a Collective Impact Model, led by an Executive Director. MOEC is housed on the campus of the University of Nebraska at Omaha, with meetings and events taking place throughout the metropolitan area. MOEC's scope continues to grow, and as of 2018 includes: 12 Public School Districts, 2 Educational Service Units, 1 metropolitan university (UNO); 2 community colleges, 132,560 PreK-12 total student enrollment; 15,627 UNO total student enrollment, 24,995 community college total enrollment, 15,337 PreK-12 personnel, 1,036 UNO personnel, and 1,190 community colleges personnel.

https://www.unomaha.edu/college-of-education/moec/

The UNO Mallory Kountze Planetarium

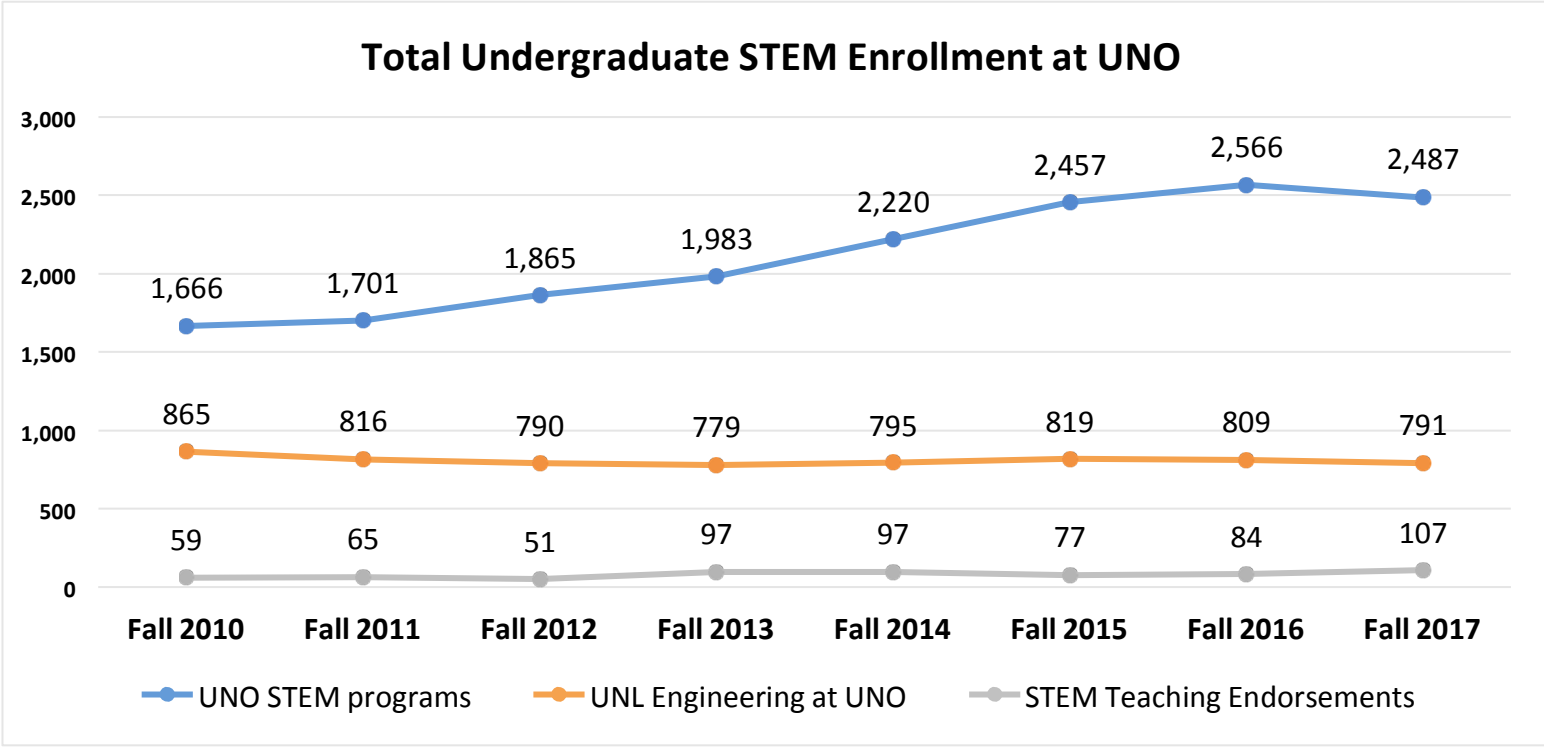
UNO has just over 10,300 paid visitors to the planetarium annually, not including the nearly 400 astronomy students that have class in the planetarium every year and those who visit for free as part of special outreach programs. The facility serves approximately 2,800 K-12 students from area school districts every school year and offers programs for Girl Scout and Boy Scout groups of all ages. For several years, the planetarium has been part of the Peter Kiewit Foundation Summer Fun program, hosting 27 programs every summer for more than 1,200 visitors. Special programs have been held for Boys Town, Silverstone Group, church groups, and even family events like birthdays or anniversaries. In addition, the planetarium routinely collaborates with groups across campus, offering programs for UNO events, such as open houses hosted by the Aim for the Stars summer program, and working with the UNO Wellness Center to bring yoga to the planetarium during wellness week. Full-dome programs covering a variety of topics and interests are provided to the public, including two new series—a Family Weekend Series with programming for children under the age of 12 years and the Art & Design Series with a focus on modern art. Other public show topics include the night sky, life and natural science, history, technology, mythology, physics, astronomy, and many more.

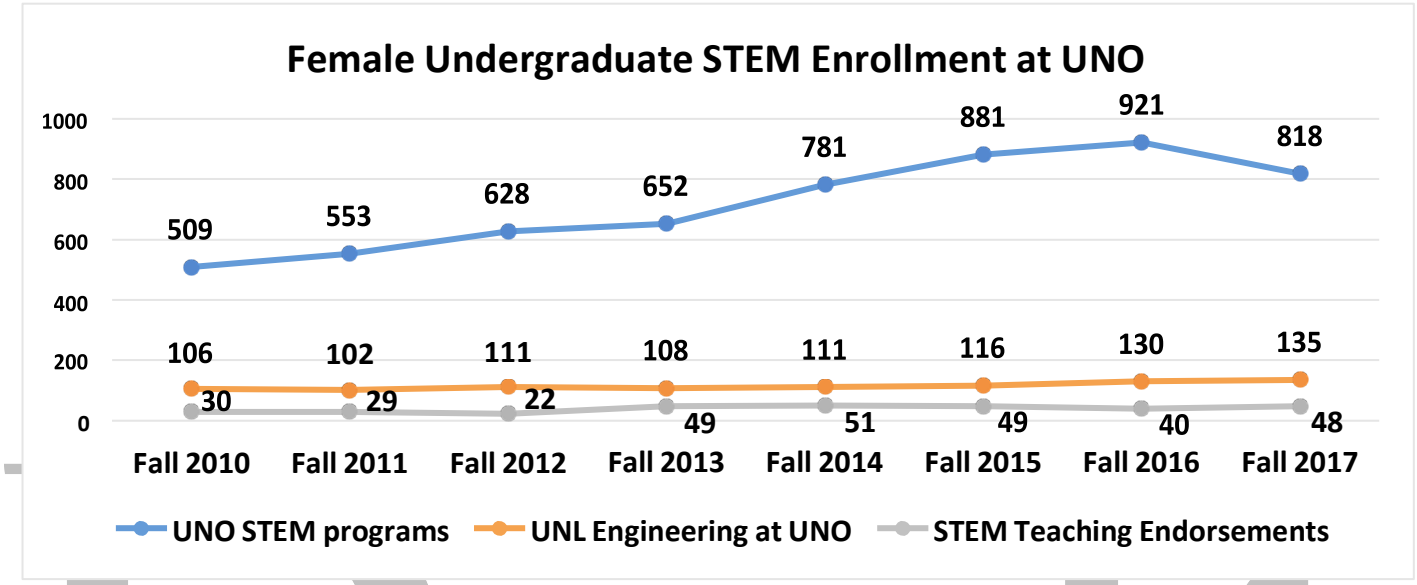
https://www.unomaha.edu/college-of-arts-and-sciences/physics/community-engagement/mkplanetarium/index.php

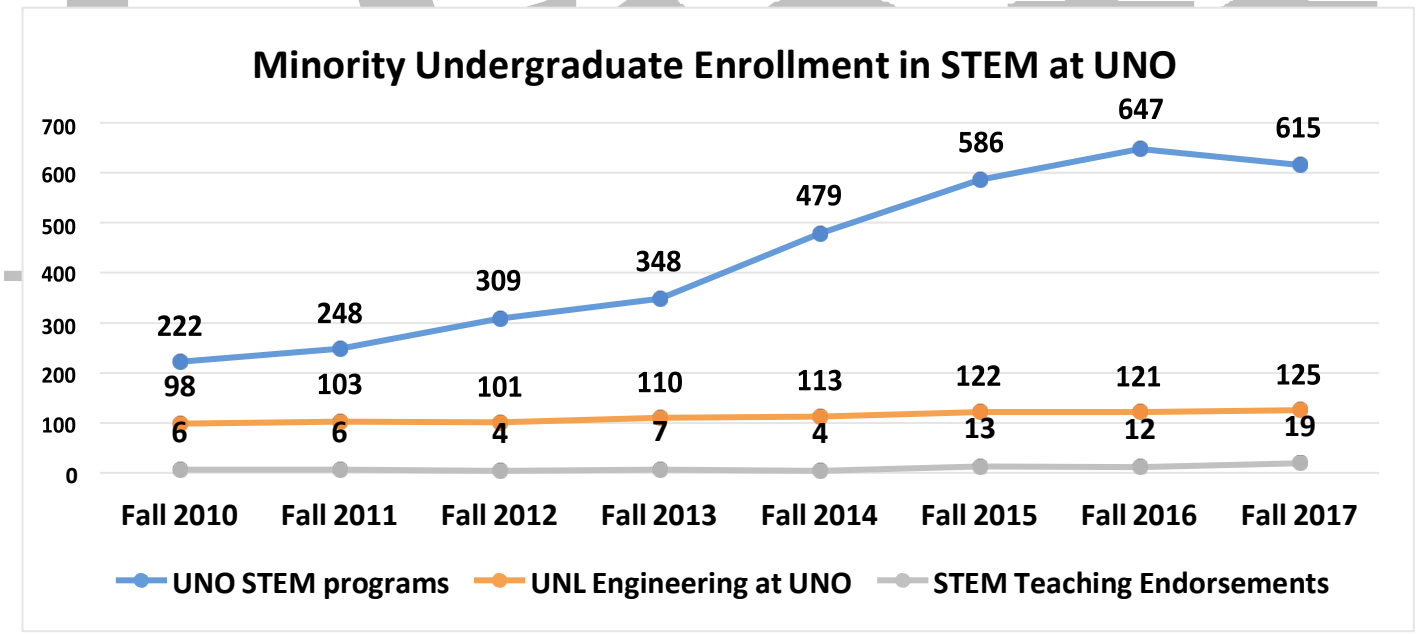
UNIVERSITY OF NEBRASKA AT OMAHA

Appendix C

STEM Progress Tables and Graphs




Female Undergraduate STEM Enrollment at UNO
1000
800
600
400
200
0
509
553
628
652
781
881
921
818
106
102
111
108
111
116
130
135
30
29
22
49
51
49
40
48
Fall 2010
Fall 2011
Fall 2012
Fall 2013
Fall 2014
Fall 2015
Fall 2016
Fall 2017
UNO STEM programs
UNL Engineering at UNO
STEM Teaching Endorsements


Minority Undergraduate Enrollment in STEM at UNO
700
600
500
400
300
200
100
0
222
248
309
348
479
586
647
615
98
103
101
110
113
122
121
125
6
6
4
7
4
13
12
19
Fall 2010
Fall 2011
Fall 2012
Fall 2013
Fall 2014
Fall 2015
Fall 2016
Fall 2017
UNO STEM programs
UNL Engineering at UNO
STEM Teaching Endorsements

University of Nebraska at Omaha Total Undergraduate Enrollment in UNO STEM - Related Disciplines								
UNO STEM-Related Disciplines	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Life Sciences								
Biology (BIOL)	481	486	534	521	622	686	736	642
Chemistry								
Chemistry (CHEM)	115	88	108	122	147	138	144	109
Geosciences								
Geography (GEOG)	45	35	32	42	40	55	47	37
Geology (GEOL)	36	35	25	26	34	33	31	44
Environmental Sciences (ENVN)	73	89	102	97	92	100	91	96
Environmental Sciences-No Concentration	23	16	17	8	6	12	15	7
Environmental Sciences-Analytical Science (ANA)	1	0	0	1	0	2	1	4
Environmental Sciences-Earth Science (EAR)	13	19	22	23	19	21	19	23
Environmental Sciences-Goegraphy & Planning (GEO)	2	9	8	9	13	10	19	24
Environmental Sciences-Life Sciences (LIF)	29	35	49	48	47	50	36	35
Environmental Sciences-BGS degree program	5	10	6	8	7	5	1	3
Mathematical Sciences								
Mathematics (MATH)	91	93	85	97	114	124	129	123
Physics								
Physics (PHYS)	39	48	62	61	58	60	59	48
Physics-Engineering (PHEN)	18	17	11	5	5	2	1	3
Computer & Information Sciences								
Computer Science (CSCI)	304	293	332	380	418	468	505	526
Management of Info Science (MIS/DMGT)	205	182	191	185	173	198	206	204
Bioinformatics (BIOI)	40	42	46	53	53	63	51	47
Information Assurance/Cybersecurity (IA,IABG)	49	74	90	107	122	153	174	205
Information Technology/Innovation/Administration (INFT/ITIN/IT	32	37	37	52	66	73	79	78
Social Sciences								
Neuroscience (NEUR)	41	89	110	122	138	133	148	137
Aviation Sciences								
Aviation (AVN)	84	81	90	105	124	153	145	166
Aviation Studies (AVST)	13	12	10	8	14	18	20	22
Total	1,666	1,701	1,865	1,983	2,220	2,457	2,566	2,487
Notes:								
Unduplicated headcount by primary majors, including BGS program students								
Source Data: Fall census enrollment files								

University of Nebraska at Omaha
Total Enrollment in STEM - Related Elementary and Middle-Level Teaching Endorsements

UNO STEM-Related Teaching Endorsements	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Elementary-Level								
END1301S (END3580): Science 7-12	19	25	24	22	18	14	14	20
ND1303S (END1465 & END1465G): Biology 7-12	1	0	0	2	3	3	6	11
END1308S (END3751): Physics 7-12	0	0	0	0	1	3	2	4
END1307S (END1695): Chemistry 7-12	0	1	1	0	1	1	3	2
END2701P: Info Tech Pk-12	0	0	0	0	1	2	4	3
END11OOJ:Math 6-12	0	0	0	0	0	0	3	18
END11OOS (END3450 & END3450G): Math 7-12	39	39	26	19	25	14	19	7
Middle-Level								
END1818M: ML Math	0	0	0	34	27	18	17	24
ENDl819M: ML Nature Science	0	0	0	20	21	22	16	18
Total	59	65	51	97	97	77	84	107

Notes:

Headcount is duplicated for multiple endorsements
Source Data: Fall census enrollment files
No comparable endorsement codes for Mid Level Math and Natural Science prior to Fall 2013
Endorsement codes in parenthesis are the codes used prior to Fall 2013

University of Nebraska at Omaha								
Female Undergraduate Enrollment in UNO STEM - Related Disciplines								
UNO STEM-Related Disciplines	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Life Sciences								
Biology (BIOL)	272	282	324	306	391	445	471	382
Chemistry								
Chemistry (CHEM)	49	39	56	58	64	69	76	55
Geosciences								
Geography (GEOG)	10	7	10	10	13	19	13	13
Geology (GEOL)	6	5	8	5	10	9	12	15
Environmental Sciences (ENVN)	30	36	37	41	42	48	46	57
Environmental Sciences-No Concentration	7	7	7	4	2	7	12	5
Environmental Sciences-Analytical Science (ANA)	1	0	0	0	0	1	1	3
Environmental Sciences-Earth Science (EAR)	9	9	11	10	9	10	6	14
Environmental Sciences-Goegraphy & Planning (GEO)	2	4	2	1	4	4	7	13
Environmental Sciences-Life Sciences (LIF)	9	13	16	22	23	24	20	20
Environmental Sciences-BGS degree program	2	3	1	4	4	2	0	2
Mathematical Sciences								
Mathematics (MATH)	30	26	25	37	47	43	38	26
Physics								
Physics (PHYS)	4	9	11	9	13	14	9	8
Physics-Engineering (PHEN)	0	0	0	0	0	0	0	1
Computer & Information Sciences								
Computer Science (CSCI)	25	30	30	34	36	53	54	68
Management of Info Science (MIS/DMGT)	32	32	26	28	20	29	32	37
Bioinformatics (BIOI)	15	12	14	14	16	19	16	16
Information Assurance/Cybersecurity (IA,IABG)	1	6	8	8	12	17	24	21
Information Technology/Innovation/Administration (INFT/ITIN/IT	4	6	3	9	9	8	13	14
Social Sciences								
Neuroscience (NEUR)	24	56	64	77	91	87	98	83
Aviation Sciences								
Aviation (AVN)	7	7	11	15	17	19	18	20
Aviation Studies (AVST)	0	0	1	1	0	2	1	2
Total	509	553	628	652	781	881	921	818
Notes:								
Unduplicated headcount by primary majors, including BGS program students								
Source Data: Fall census enrollment files								

University of Nebraska at Omaha								
Minority Undergraduate Enrollment in UNO STEM - Related Disciplines								
UNO STEM-Related Disciplines	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Life Sciences								
Biology (BIOL)	75	99	113	118	168	204	247	195
Chemistry								
Chemistry (CHEM)	19	15	25	33	59	58	65	44
Geosciences								
Geography (GEOG)	3	1	3	5	3	9	7	6
Geology (GEOL)	0	2	2	4	5	4	3	8
Environmental Sciences (ENVN)	5	8	12	11	6	13	15	20
Environmental Sciences-No Concentration	2	3	1	0	0	3	3	2
Environmental Sciences-Analytical Science (ANA)	1	0	0	0	0	1	0	1
Environmental Sciences-Earth Science (EAR)	2	2	3	4	2	3	5	4
Environmental Sciences-Goegraphy & Planning (GEO)	0	1	2	1	1	0	1	3
Environmental Sciences-Life Sciences (LIF)	0	2	6	6	3	6	6	9
Environmental Sciences-BGS degree program	0	0	0	0	0	0	0	1
Mathematical Sciences								
Mathematics (MATH)	13	13	12	14	16	21	24	31
Physics								
Physics (PHYS)	2	6	9	6	6	8	10	8
Physics-Engineering (PHEN)	1	1	1	0	0	0	0	1
Computer & Information Sciences								
Computer Science (CSCI)	44	34	43	56	79	95	101	103
Management of Info Science (MIS/DMGT)	29	30	30	35	35	45	50	51
Bioinformatics (BIOI)	8	6	7	10	9	14	10	12
Information Assurance/Cybersecurity (IA,IABG)	4	5	6	11	14	23	28	40
Information Technology/Innovation/Administration (INFT/ITIN/IT	2	3	3	1	12	15	13	13
Social Sciences								
Neuroscience (NEUR)	8	15	20	27	44	45	45	47
Aviation Sciences								
Aviation (AVN)	8	7	17	16	21	29	26	32
Aviation Studies (AVST)	1	3	6	1	2	3	3	4
Total	222	248	309	348	479	586	647	615
Notes:								
* Minority includes: American Indian, Asian, African American, Hispanic, Native Hawaiian or Pacific Islanders, and Two or more races								
Unduplicated headcount by primary majors, including BGS program students								
Source Data: Fall census enrollment files								

University of Nebraska at Omaha

Female Enrollment in STEM - Related Elementary and Middle-Level Teaching Endorsements

UNO STEM-Related Teaching Endorsements	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Elementary-Level								
END1301S (END3580): Science 7-12	9	13	14	10	7	5	5	6
END1303S (END1465 & END1465G): Biology 7-12	0	0	0	1	1	1	1	5
END1308S (END3751): Physics 7-12	0	0	0	0	0	0	0	0
END1307S (END1695): Chemistry 7-12	0	1	0	0	1	1	2	1
END2701P: Info Tech Pk-12	0	0	0	0	1	1	2	0
END1100J: Math 6-12	0	0	0	0	0	0	2	9
END1100S (END3450 & END3450G): Math 7-12	21	15	8	9	13	15	9	1
Middle-Level								
END1818M: ML Math	0	0	0	18	16	12	10	15
END1819M: ML Nature Science	0	0	0	11	12	14	9	11
Total	30	29	22	49	51	49	40	48

Notes:

Headcount is duplicated for multiple endorsements

Source Data: Fall census enrollment files

No comparable endorsement codes for Mid Level Math and Natural Science prior to Fall 2013

Endorsement codes in parenthesis are the codes used prior to Fall 2013

University of Nebraska at Omaha

Undergraduate Minorities STEM Enrollment--UNL Engineering Program at UNO

UNL Engineering Programs at UNO	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Architectural Engineering	11	17	14	16	12	13	12	17
Civil Engineering	25	28	23	33	34	39	41	34
Computer Engineering	14	16	13	16	17	12	12	17
Construction Engineering	8	4	4	3	5	4	7	8
Construction Management	11	8	12	8	7	9	11	7
Electrical Engineering	0	0	0	0	4	12	18	17
Electronics Engineering	12	13	16	11	14	14	9	6
Fire Protection Technology	1	2	1	1	0	0	0	0
Pre-Agricultural Engineering	0	0	0	0	0	0	0	0
Pre-Biological Systems Engineering	1	0	2	2	0	1	1	1
Pre-Electrical Engineering	3	2	1	6	2	1	0	0
Pre-Engineering	10	10	9	11	8	7	8	10
Pre-Mechanical Engineering	2	3	6	3	10	10	2	8
Total	98	103	101	110	113	122	121	125

Notes:

* Minority includes: American Indian, Asian, African American, Hispanic, Native Hawaiian or Pacific Islanders, and Two or more races

Unduplicated headcount by primary majors

Source Data: Fall census enrollment files

University of Nebraska at Omaha
Undergraduate Female STEM Enrollment--UNL Engineering Program at UNO

UNL Engineering Programs at UNO	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 201S	Fall 2016	Fall 2017
Architectural Engineering	SO	43	41	43	46	SO	S3	S6
Civil Engineering	30	27	28	27	27	27	39	33
Computer Engineering	6	7	10	9	9	6	12	9
Construction Engineering	4	3	3	2	3	3	3	S
Construction Engineering Tech	0	1	0	0	0	0	0	0
Construction Management	4	S	S	S	8	8	9	12
Electrical Engineering	0	0	0	0	0	3	6	10
Electronics Engineering	4	4	7	9	8	4	2	0
Fire Protection Technology	2	1	2	1	0	0	0	0
Pre-Agricultural Engineering	0	0	0	0	0	1	0	0
Pre-Biological Systems Engineering	0	0	2	3	0	1	1	1
Pre-Electrical Engineering	1	1	2	3	0	0	0	0
Pre-Engineering	3	7	7	S	7	8	4	6
Pre-Mechanical Engineering	2	3	4	1	3	S	1	3
Total	106	102	111	108	111	116	130	13S

Notes:
Unduplicated headcount by primary majors
Source Data: Fall census enrollment files

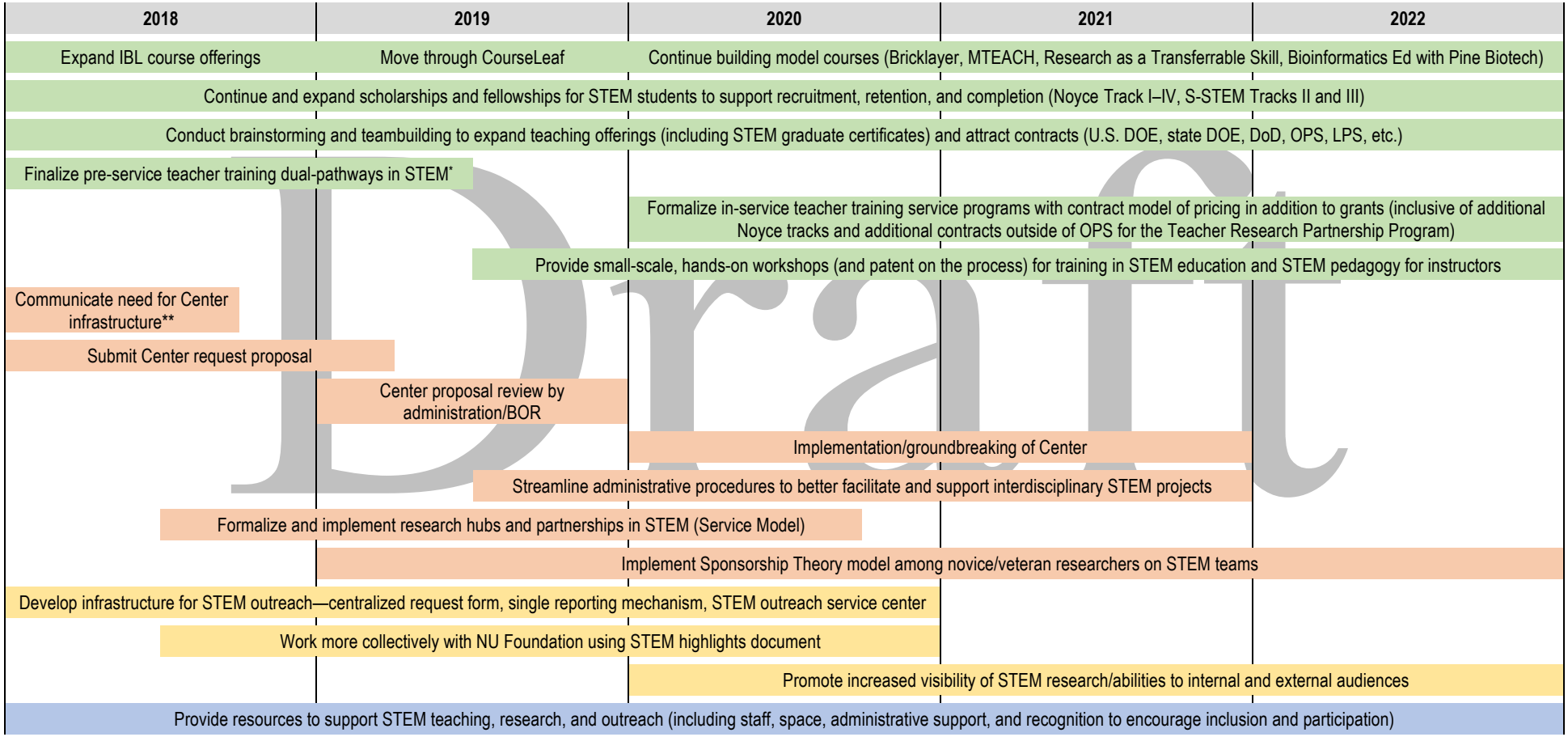
University of Nebraska at Omaha
Total Undergraduate STEM Enrollment--UNL Engineering Program at UNO

UNL Engineering Programs at UNO	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Architectural Engineering	221	203	171	166	166	164	159	169
Civil Engineering	206	199	188	209	207	214	226	212
Computer Engineering	92	82	97	9S	111	98	94	100
Construction Engineering	4S	39	36	2S	30	22	24	26
Construction Engineering Tech	2	1	0	0	0	0	0	0
Construction Management	107	103	93	86	89	99	89	79
Electrical Engineering	0	0	0	0	8	37	S7	99
Electronics Engineering	69	6S	81	69	76	69	S7	22
Fire Protection Technology	26	23	16	4	0	0	0	0
Pre-Agricultural Engineering	1	0	0	1	0	1	0	1
Pre-Biological Systems Engineering	2	2	4	4	1	4	8	S
Pre-Electrical Engineering	1S	1S	9	11	8	4	2	1
Pre-Engineering	SO	SO	SO	69	49	62	S3	44
Pre-Industrial Engineering	0	1	0	0	0	0	0	0
Pre-Mechanical Engineering	29	33	4S	40	SO	4S	40	33
Total	865	816	790	779	795	819	809	791

Notes:
Unduplicated headcount by primary majors
Source Data: Fall census enrollment files

Appendix D

STEM Priority: Timeline of Teaching, Research, and Outreach Initiatives, 2018–2022



*Noyce track I, in-discipline teacher pathways in math and science—done in all sciences except one department at this time

**Communicate research needs related to human resources, streamlining grants management, developing research culture, strategizing to manage faculty workload and prevent burnout

UNIVERSITY OF NEBRASKA AT OMAHA

Appendix E

STEM Teaching, Research, And Inquiry-based Learning (STEM TRAIL) Center

Descriptive Information for the STEM Center Concept

- **Name of institution proposing the Center or Institute:** The University of Nebraska at Omaha
- **Name of the programs involved:** STEM Leadership Team Faculty and Staff and programs overseen by that team
- **Other programs offered in this field by this institution:** None
- **Administrative unit for the Center or Institute:** [Recommended] A Director and Associate Director, supported by Assistant Directors (amongst other staff) represented by the STEM Community Chairs. All entities organizationally report to the Director. The Director of the Center reports fiscally to the Senior Vice Chancellor, with academic oversight and reporting to the cognizant STEM Deans.
- **Physical location, if applicable:** TBD
- **Date approved by governing board:** TBD
- **Proposed date (term/year) the Center or Institute will be initiated:** Spring 2020

1. Purpose and Context for the Center or Institute

As a national priority, science, technology, engineering and mathematics (STEM) education is, at its essence, an interdisciplinary approach to teaching, research, and outreach (Congressional Research Office 2002; NSF 2017) that engages students in learning cross-discipline concepts and practices—such as the scientific method, engineering design, mathematical modeling, and computational thinking—using innovative, hands-on pedagogical strategies. By integrating such strategies—including inquiry-based learning (IBL) and genuine scientific research experiences—into our nation's formal and informal education programs, we will prepare our students and citizens to become highly skilled professionals that can effectively create, manage, and sustain the essential technological innovations of the 21st century. UNO has a proud history of contributing to this national call for innovative STEM programming by identifying STEM as a campus priority and implementing a plan to attract key STEM leaders. It is within this context that we propose taking the next steps toward solidifying UNO's status as a national leader in STEM by designating an interdisciplinary STEM Teaching, Research, and Inquiry-based Learning (STEM TRAIL) Center.

Our growing metropolitan university has already created a synergistic environment for advancing STEM in the region, thanks in part to UNO's innovative structure for interdisciplinary STEM leadership, in which community chairs have been appointed to promote collaborative STEM initiatives, working closely with campus deans, department chairs, and community partners. These collaborative efforts have led to many successes, including achievements such as new interdisciplinary STEM courses and certificates offered jointly across UNO colleges, shared pathways for STEM disciplinary degrees and teacher certification, significant external funding for collaborative STEM initiatives, numerous discipline-based education research (DBER) publications, innovative STEM outreach endeavors and events, community-wide

leadership for a new Omaha STEM Ecosystem organization, and most importantly, an evolving interdisciplinary vision for STEM on the UNO campus. It is now time for UNO STEM to further evolve into a national model, using a Center-based strategy for engaging students in effective STEM pathways or "educational trails" into their careers by designating and supporting the STEM TRAIL Center.

National initiatives for advancing STEM have uniformly identified student engagement in research-related activities as the key educational innovation for preparing the next generation of professionals. George D. Kuh's high-impact practices for universities include the meaningful integration of research as a focused pedagogy for engaging students in the undergraduate classroom (Kuh 2008). Moreover, national societies are dedicated to the advancement and training of students in STEM via the apprenticeship style of research experiences (e.g., Council of Undergraduate Research, SigmaXi) and working on complex problems in interdisciplinary teams (Kuh 2008). Finally, recent calls from the National Science Foundation (NSF) and the Carl Wieman Science Education Initiative at the University of British Columbia (Deslauriers, Schelew, & Wieman 2011) further recommend that innovative engagement experiences, such as research in undergraduate classrooms, be available to *all* students, inclusive of those enrolled in large freshman courses in STEM and those at higher levels including those at the very highest levels of potential. Consequently, the novel pedagogy of "course-based undergraduate research experiences (CUREs)" was born and will also be a fundamental core element of the UNO STEM TRAIL Center.

Integrating research into the classroom not only enhances student learning and skills in STEM, but it also augments student ability to communicate, conjecture, and debate (Elgin *et al*. 2016; Price 2001; Schmid 1992; Beard & Booke 2016). Copious articles in the cognitive and learning sciences, inclusive of the scholarship of teaching and learning and DBER, document the importance of mentored research experiences for students. The benefits of these experiences are captured robustly via the CURE and SURE surveys that were developed by David Lopatto (Grinnell College) and are utilized around the world. Taken together, these examples illustrate that the importance of undergraduate research experiences—both in the classroom and outside of the classroom—cannot be understated. Consequently, the UNO STEM team increasingly uses research experiences—for undergraduates, graduate students, and in-service teachers alike—as a pedagogical tool to convey content, increase learner confidence, and empower students to be able to meet the demands of the 21st century job market (Cutucache *et al.,* 2018). Further, this direction is highly consistent with other campus initiatives, such as the new Research Strategic Plan being led by UNO's Vice Chancellor for Research, in which increased student involvement in research and the opportunities for interdisciplinary STEM efforts are mentioned as key opportunities for continued growth in research on the UNO campus. It is also very consistent with new campus directions that will strive to recruit, educate, and graduate some of the very best STEM students in the country.

In addition, the UNO STEM team has expanded the use of inquiry-based learning (IBL) in the STEM disciplines over the last five years. Grants, workshops, and publications from the STEM team clearly highlight the importance, transferability, and impact of offering IBL courses. Interdisciplinary, cross-college teaching also has become more prevalent, and IBL is already an emerging core effort in UNO STEM. For example, UNO faculty from computer science and mathematics are partnering to offer a new inquiry-based course, MATH 1120: Introduction to Mathematical and Computational Thinking, using Bricklayer (an open-source, online educational ecosystem developed at UNO). Another cross-campus partnership, among computational biologists, cancer biologists, and mathematicians, is integrating inquiry into the classroom via their work on the dynamic modeling of diseases, biological phenomenon, cancer, and the immune response. The integration of bioinformatics into life sciences education serves as yet another example of a cross-college faculty initiative (that also includes partners external to UNO) focused on providing high-quality, inquiry-based experiences for students in the classroom.

UNO's successes in STEM are a direct result of the deliberate and focused implementation over the past five years of the 2013 STEM Strategic Plan, which was developed in support of the campus-wide STEM priority, in close collaboration with UNO deans and departments. The STEM TRAIL Center will build upon this earlier STEM momentum to further establish our national reputation, propagate our proven best practices on a national stage, position ourselves to compete for new types of extramural funding, and to serve as a contractual entity to assist other universities and stakeholders in the design, assessment, and implementation of STEM-related teaching, research, and outreach projects.

Specific offices housed within the Center will serve as liaisons to key stakeholders in the STEM research and education arenas and are anticipated to include the following: 1) the office of the Nebraska Science Learning, Education, Assessment, and Design (NE SciLEAD) Consortium, which will provide leadership and consulting relative to designing and assessing STEM-related education research projects; 2) the STEM Outreach office, which will house staff to coordinate STEM outreach efforts across campus, thereby avoiding duplication of duties and facilitating shared branding for UNO's increasingly diverse STEM outreach initiatives; and 3) the Office of Computer Science Education, 4) An office to house STEM Faculty Fellows (i.e. NU faculty that are selected as Fellows in the Center for one semester at a time), Teaching STEM Fellows (in-service teachers supported on Noyce awards for genuine research, or via the Teacher-Researcher Partnership Program), and Graduate STEM Fellows (GAs pursuing DBER degrees), and for International STEM Faculty Fellows on sabbaticals, 5) An Office of Student Program Innovations—including programs involving research as a pedagogy, ranging from researchers and their students on a given project to outreach programs utilizing data-driven approaches for student success, 6) STEM Ed incubator office (to house start-ups or pre-startups, advise on grant writing, and IP) and 7) an Administrative Office housing the Director, Associate Director, and other STEM Community Chairs, which will provide general administrative structure for the Center.

Academic oversight of the Center would be facilitated by direct collaboration and coordination with the Deans of the Colleges of Arts and Sciences, Education, and Information Science and Technology. Fiscal oversight, as is common for academic STEM Centers nationally that cross colleges, is recommended to report through the Senior Vice Chancellor for Academic Affairs, while including STEM Deans and the Chief Research Officer in fiscal updates and financial sustainability efforts of the Center.

2. Need, Demand, and Opportunity for STEM Center Organizational Unit

Based on expansion of the 2013 STEM Strategic Plan (STEM Strategic Plan, Phase II: 2018–2023), a 2015 STEM Priority Report, a 2018 Qualtrics survey of STEM faculty and staff, market research analysis, organizational conversations with national entities (such as the Council of Undergraduate Research), and various structured brainstorming meetings among members of the STEM Leadership Team and campus collaborators, we believe the most effective infrastructure to advance STEM on the UNO campus is a formalized STEM Center. Such a Center will provide the administrative and physical infrastructure needed for UNO faculty to adapt quickly to meet changing economic conditions, STEM workforce development needs, and training needs for students in the state of Nebraska. Specifically, **we recommend that the STEM TRAIL Center provide the following tangible resources to faculty:**

- A shared organizational entity to coordinate interdisciplinary UNO input, planning, and strategic action for P16 STEM Learning in close collaboration with community partners, such as school districts, businesses, and the community
- Collaborative spaces and activities dedicated to and focused efforts on creating innovative courses that implement undergraduate research experiences, inquiry-based learning, problem-based

learning, CUREs, and other STEM pedagogies that empower students to be critical thinkers and problem solvers to be demonstrated on an international scale

- Shared and collaborative spaces for housing research initiatives in STEM areas (including wet-bench research space, social science workspace, graduate students and faculty in residence, conference rooms, and showcases for STEM research dissemination)
- A base for professional development resources, consulting, and contracted services of the NE SciLEAD Consortium related to the design, assessment, and implementation of STEM-related teaching, research, and outreach projects
- An array of workshops dedicated to aggressively developing grant proposals for submission to extramural entities (to include hosting program officers and scientific review officers from NSF and NIH, respectively)
- A STEM Outreach office and structure to provide a shared vision and workspace for outreach personnel across colleges and to facilitate coordination of STEM-related outreach activities with partners across campus and in the community
- Faculty support offices (to assist faculty with IP considerations, external start-up assistance, DBER training, and grant conceptualization assistance)
- A periodic seminar series to encourage and to support interdisciplinary STEM research and instructional innovation
- A pre-tenure advisory committee to support interdisciplinary STEM research productivity, inclusive of grant mentoring, editing, and peer support strategies
- A seminar space and mechanism to hold 350 people for STEM community engagement lectures, workshops, Aim for the Stars expos, STEM Ecosystem events, etc.
- Office space for STEM personnel, inclusive of directors of the new offices within the Center

3. Progress to Date on the STEM Priority

Over the last five years, UNO has recruited and strongly supported a STEM Leadership Team using an innovative and effective community chair model. This cross-college interdisciplinary leadership team has established a productive record of program development, extramural funding, and educational best practices that has radiated through academic units across campus and into partner organizations across the Omaha metropolitan area. In 2016, the UNO STEM Leadership Team and Omaha Citywide STEM Ecosystem received national recognition for their efforts, earning UNO an exemplary designation for the W.K. Kellogg Foundation's Community Engagement Scholarship Award. Building on this foundation, UNO is prepared to move to the next level in propagating successful collaborative models in STEM education.

4. Adequacy of Resources

The most difficult resource to gather—effective and committed leaders—is already in place due to past UNO support and vision, and the enthusiastic participation of faculty, staff and administrators. While much good has been accomplished and will continue to flow from these STEM leaders who attend STEM Leadership Team meetings—now numbering 57 faculty members, along with supportive staff and administrators—continued progress requires the organizational structure and funding possibilities of a designated Center. Most importantly, we believe that establishing a Center will help launch a new trajectory for STEM, allowing UNO to recruit additional personnel and provide the physical resources necessary to capitalize on existing synergistic STEM initiatives across the region and elevate the University of Nebraska to a place of national eminence in STEM.

Personnel

The STEM Community Chairs are funded by donor endowments, and most faculty leading STEM-related initiatives are supported by extramural grants, in addition to funds provided within a supportive college environment. The administrative support infrastructure for many campus-wide elements of the STEM priority such as Outreach, however, is currently limited to one campus-wide FTE position funded by the University for a STEM Outreach Coordinator. Individual colleges certainly work hard to fund and staff STEM outreach positions that are appropriately specific to the given college. While this structure has been sufficient and useful for our interdisciplinary efforts to date, it does not allow for continued shared growth as we become an increasingly visible national model competing for external funding at the highest levels of national achievement. Growing interdisciplinary STEM initiatives across colleges will take additional cross-college organization. Furthermore, the current support model can inadvertently penalize highly productive faculty and their units and colleges—for example, the more successful faculty are in securing extramural funding for DBER, the more they must add post award administrative roles to their list of duties, at times stressing their departmental and college support infrastructures, particularly when their unit may have only a partial role in the wider STEM initiative. When faculty and departments take on this interdisciplinary work, which could be completed more efficiently and effectively by a shared staff assistant, it ends up costing an individual college money, and costs may be disproportionate for a particular unit. Finally, while each STEM faculty member are appropriately housed within a single academic department, STEM initiatives are inherently interdisciplinary and often fall outside the purview of any individual department. The administrative paperwork accompanying cross-campus STEM projects puts increasing stress on departmental staff assistants. Designating a STEM Center would make it possible to use a pooled staff model, that could perhaps work more efficiently with departments and colleges to maximize F&A return to units, while also funding a shared percentage of STEM administrative support, equipment purchases, consistent/sustainable personnel hires, and graduate student support for STEM initiatives, thereby incentivizing faculty and synergizing their efforts to continue expanding extramural support for UNO STEM initiatives. Of course, we realize that financial structures will need to be carefully worked out within UNO's existing administrative structures, but this vision and direction increasingly seems to have potential and may well be a necessity for taking UNO STEM to the next level nationally.

Physical Facilities

Perhaps the most glaring resource need for future campus growth in STEM is the need to renovate or replace the increasingly dated physical infrastructure, which all students, faculty, departments, and colleges share. Although colleges try hard to maximize collaboration for instructional spaces, there is really only *one* shared space dedicated to STEM on campus, and that is the STEM Learning Laboratory in Roskens Hall room 402. This is a renovated space from the early days of Roskens Hall repurposing that can be utilized by all STEM Leadership Team faculty, and it serves as a wet-lab and collaboration room. This room holds 40 individuals and only accommodates short-duration experiments. The room is also reserved by various campus groups, thus impeding any long-term experiments or initiatives in progress, even if funded extramurally (e.g., we have a faculty member funded by NASA who has no available lab space to conduct his laser work). Because these limitations of physical space impede our further growth and development in STEM research, we formally request to enter into administrative conversations about conceptualizing and planning for a shared building dedicated to the STEM TRAIL Center.

The idea for an interdisciplinary STEM-devoted building on the UNO campus is certainly not new. More than once over the last few years, campus administrators have initiated the idea and hired consulting and architectural input while engaging faculty in discussing ideas and site plans for a STEM building. While we know that suggesting a location for any Center would certainly be premature, many STEM faculty have

shared a collective opinion on the optimum location in past conversations, so we feel compelled to at least mention it here. The STEM faculty believe that the most useful location for the proposed Center would be the current parking lot northwest of the Durham Science Center. This location would allow for ease of collaboration among STEM faculty on campus, as well as ease of entering and exiting campus for community partner organizations and individuals attending STEM meetings and events, including after-hours events and outreach activities. However, we of course realize that deciding feasible locations for a new building or similar space infrastructure is a very complex process that typically requires extensive expertise, planning, and conversations with many different stakeholders. We again mention our thoughts here to simply help to support the campus's movement in this direction, while also identifying that in our opinion, systematically moving to a higher level of STEM distinction and attracting the best and brightest STEM students in the country will no doubt require systematic facility innovation as well as program innovation.

While a new interdisciplinary building to house the aforementioned offices for the STEM TRAIL Center are to some degree essential for taking STEM to the next level, we also recognize fully that any growth in STEM is similarly dependent on renovations for individual STEM Departments (even on a phased implementation) to both Allwine Hall and the Durham Science Center. Therefore, we formally request renovations of the two existing buildings to continue to be considered as well.

Instructional Equipment and Informational Resources

Instruction within the STEM TRAIL Center will be particularly devoted to model courses utilizing inquiry-based learning and research experiences at the undergraduate and graduate levels. Some innovative courses might have specially designed sections for important populations of students, such as targeting high-achieving students, dual enrollment students, or students enrolled in high school bridge courses. Thus, laboratory spaces in the Center will need to be flexible spaces with room to accommodate approximately 50–80 students—which is significantly more than can be accommodated in existing labs in Allwine Hall or the Durham Science Center. The larger laboratory spaces will support increased credit-hour production via high-impact STEM courses that will also aggressively target student recruitment into STEM pathways. In addition, each room will require moveable tables and chairs, a smart board and projector, as well as white boards and student workstations with displays for group work. We also believe that serving exceptionally academically talented STEM students in special sections will allow us to pilot innovative student engagement strategies, such as mentored student research experiences, that can then be translated to other sections, informing student involvement across all STEM areas and student populations.

Budget Projections

In faculty brainstorming conversations on the STEM Strategic Plan and its evolution into the idea of a STEM Center, the question of facilities often surfaced. We realize that space and facilities consideration for a new Center may require a significant investment, perhaps $15 million or more, and we know that decisions about such financial investments are appropriately made at higher levels of the University administration. We do, however, suggest that a new STEM building and similarly STEM-related renovated spaces would be a powerful catalyst to increased student recruitment, educational innovation, extramural funding, tuition income, and other income-generating opportunities (such as consulting contracts). The participating faculty will certainly strive to increase the total extramural dollars applied for and awarded to the University, and it is anticipated that the F&A distribution would help to eventually maintain the Center without limited University operational resources. For an eventual full operation, we anticipate that the Center might well require two dedicated staff assistants, two research faculty, two professors of practice, and two STEM coordinators. We offer suggestions here only as a potential springboard to future

conversations as, like decisions about operational and instructional space, we realize that personnel decisions are multi-faceted, complex, and require significant conversations on many levels.

Anticipated **administrative expenses** for the STEM TRAIL Center include the following:

- Executive Director—50% of workload will go to oversight of the Center
- Associate Director 50% of workload will go to oversight of the Center
- Co-Assistant Directors—25% of workload will go to operations of the Center
- Research Assistants—2 FTE personnel ($65k/year x 2 x 5 years, plus benefits, then reduced to 1 FTE after 5 years, with grants supporting future years)
- STEM Coordinators—2 FTE personnel ($55K/year x 2)
- Staff assistants—2 FTE personnel ($48K/year x 2)

Anticipated **programming expenses** would be partially covered by a "Center Operating Fund" of $150,000/year as a state-aided line item, with the remainder covered by a percentage of Center F&A return and grants funded by federal sources, similar to other Centers across the NU System and the country. Other income sources would potentially come from consulting contracts and intellectual property royalties, which would also be a focused operational element of the Center.

5. Organizational Structure and Administration

The recommended administrative structure of the STEM TRAIL Center includes an Executive Director, Associate Director, and Assistant Directors (Community Chairs) working in collaboration with a steering committee and subcommittees to direct and oversee Center operations, including various offices in the Center (e.g. the STEM Outreach office and the office of the NE SciLEAD Consortium), although each Office will have a specific Director with at least 25% appointment to that Office. We recommend that the acting Executive Director and Associate Director be the Community Chairs of Science and STEM Education, respectively, on an interim basis until a permanent Director can be hired via a formal search process.

Center Directors and Executive Administrative Reporting Process

We recognize fully that Center organizational structures are foundational to the future success of any Center and we ask the STEM Deans at UNO to help us to develop an organizational structure within the Center that would facilitate close coordination with their colleges and their departments. Such coordination is a critical facet of any successful Center at UNO and would even be more important in the case of UNO STEM, which has a history of working closely with administrators, faculty, and staff across colleges and departments for collaborative achievements. Operational structures that support continued communication and collaboration will be increasingly important as initiatives grow and expand. Although it may be premature (like in the space recommendations) to recommend an organizational structure per se, internal conversations have identified that using the STEM Community Chairs as a core leadership structure might be the most workable. For example, one possible model might be to have the STEM Community Chair of Science serve as Director and the Community Chair of STEM Education serve as Associate Director, with each of the other participating STEM Community Chairs (Computer Science, Mathematics, and Physical Science) serving as Assistant Directors (and/or leads of major offices in the Center). Responsibilities could then be divided among the participating community chairs who already collaborate closely with STEM colleagues. In a structure like this, the Directors could co-oversee all operations of the Center, inclusive of signing off on documents and grant applications from the Center. We also recommend that the Directors academically report to the STEM deans (i.e., the deans of Arts and Sciences, Education, Information Science &

Technology, and potentially, the College of Public Affairs and Community Service), while reporting fiscally to the Senior Vice Chancellor for Academic Affairs (since the Center crosses colleges) with fiscal updates and disclosures to the Deans, and close communication with the Associate Vice Chancellor for Research and Creative Activity.

Steering Committee and Subcommittees

A deans-appointed Steering Committee will serve as the principal decision-making body within the Center and will include subcommittee leadership to oversee specific focus areas of the Center (see below), but ultimately all decisions of the Center would rest with the Director as the final decision maker for internal oversight of the Center. The Directors will co-chair the Center's Steering Committee. Other members will include chairs of the subcommittees and representation from the offices within the Center. The Directors will convene meetings at least once monthly and more often as needed. The Directors will hold monthly meetings with the supervising deans, to particularly ensure that Center initiatives are also closely aligned with college missions and initiatives. Finally, bylaws will be drafted to establish the responsibilities of the committee. Anticipated subcommittees of the Steering Committee could include the following:

- **Interdisciplinary Research as a Pedagogy in *Teaching***—Chaired by a faculty member from a STEM discipline who engages in active learning or student-centered learning environments in his/her classroom and has demonstrated success in attaining (or has the potential to attain) extramural funding in this area.
- **Interdisciplinary Strategies as a Catalyst for *Research***—Chaired by a faculty member from a STEM discipline who has an active research group/laboratory (active to include publishing approximately 1–2 times/year on an ongoing basis), has a history of mentoring students, and has demonstrated success in attaining (or has the potential to attain) extramural funding in this area.
- **Interdisciplinary STEM *Outreach***—Chaired by a STEM Outreach Coordinator who will also serve as the Director of the STEM Outreach office.
- **Pre-tenure Sponsor Advisory Team**—Chaired by a faculty member at the Associate or Full Professor level who has maintained a research-productive vitae. The advisory team for pre-tenure faculty in STEM areas will be composed of research-productive, tenured professors at the Associate or Full Professor level who will advise pre-tenured faculty in STEM areas on their portfolios, serve as additional editors and reviewers for grant proposals, and provide twice-annual grant writing workshops.

STEM Outreach Office

In collaboration with the STEM Outreach subcommittee, the STEM Outreach office will focus on ensuring public engagement and recognition of the Center, aligning needs of stakeholders with priorities of the Center, and advising all STEM Outreach staff across campus on best practices, inclusive of evaluation and assessment strategies. Members of the STEM Outreach office and subcommittee will collaborate with the Research subcommittee as needed to ensure extramural funding (or, at the very least, sustainable funding) is available to implement and support STEM outreach activities that contribute to broader impacts of the Center's DBER efforts.

Office of the NE SciLEAD Consortium

A new and innovative entity in the STEM TRAIL Center will be the office of the NE SciLEAD Consortium, which will fill a gap in regional and national markets by providing contracted consulting services in the design, implementation, evaluation, and assessment of STEM education research and programming, as well as academic program assessment. The Consortium currently has four partners (UNO, UNL, UNK, and Beyond School Bells), and demand for their services is high and increasing. The Consortium is conceptualized to eventually have dedicated office space and two permanent professional-

level staff who will be trained in mixed-methods research, phenomenological research, and STEM-related assessment tools and strategies, including, for example, the Youth Program Quality Assessment (YPQA), Dimensions of Success (DoS) observation tool, Classroom Assessment Scoring System (CLASS), and other DBER and cognitive sciences protocols. Services offered by the NE SciLEAD Consortium will include contracted external evaluation for NSF-, DOE-, or NIH-funded awards. In addition, this office will serve as the point of contact for graduate students interested in pursuing DBER or ultimately becoming professors, providing training in the learning sciences and connecting students with research and teaching opportunities. This office is also targeted to be a revenue generator for the Center, while also being a catalyst to entrepreneurial endeavors that may for example work with UNeMed. The STEM Leadership Team has already met with UNeMed to brainstorm possible future strategies.

Office of Computer Science Education

The Office of Computer Science Education would be directed by the Community Chair of Computer Science. UNO leads the state in computer science education, with new programs such as a Supplemental Teaching Endorsement and a M.S. in Computer Science Education. This office would help to facilitate UNO's increasingly national models for helping P12 schools to integrate CS as a true partner with other STEM disciplines. Specifically, UNO's growing national leadership in CS Education (including several visits to the White House) would help to be facilitated by this office would be devoted to ongoing implementation of innovative pre-service and in-service teacher training to address this critical national workforce challenge.

Office of STEM Fellows

The Office of STEM Fellows will help to facilitate "fellows" at various levels—to include NU Faculty that aim to work on-site for a semester or more at a time, in-service STEM teaching fellows (e.g. as funded by a Noyce Track IV award or via the Teacher Researcher Partnership Program), graduate students working on degrees in STEM Education, and finally for international colleagues on international STEM issues or initiatives. The office will be dynamic in using data-driven best practices for training and ongoing professional development (including fee-based workshop series) for training of all fellows in a personalized way.

Office of Student Programming Innovations

This office will help to mentor and to facilitate meeting and work spaces for funded undergraduate students from UNO involved in high impact practices (Kuh, 2008) centered around research as a pedagogy. For example, this space will be a base of operations and workspace for all Noyce Interns and Scholars (from all areas of science and mathematics), as well as all NE STEM 4U students from all colleges on campus. Additionally, we anticipate acquiring grants such as NSF Research Experiences for Undergraduates (REU) funding for summer experiences and this collaborative workspace would also house those participants.

STEM Ed Incubator Office

This office will house externally funded student interns, with specialized skills in marketing, market analysis, economics, statistics and STEM education to allow students and faculty alike to take ideas from conception to market stage. This office will also be the point of contact to communicate with the IP firms regarding upcoming technologies or processes (for patenting, trademarks, licensing, etc.), such as Center developed and marketed educational assessments. This office will also be the liaison with UNeMed and Nebraska Business Development Center to ensure that new technologies make it to market quickly.

Administrative Office

The STEM Community Chairs, with roles of Director, Associate Director, and Assistant Directors, as well as staff assistants, program support personnel (research assistant professors, staff assistants, and key graduate assistants) will be housed in a single office. This office will serve as the administrative hub for the Center and facilities and communicate and advise on key stakeholder partnerships and oversee operations.

6. Partnerships with Businesses and the Citywide STEM Ecosystem

The proposed STEM TRAIL Center will engage in collaborative partnerships with both business and community organizations, synergistic with UNO's leadership role in the Citywide STEM Ecosystem. There are more than 90 organizations represented in the STEM Ecosystem, many of which already collaborate directly with UNO on STEM initiatives, including the Metropolitan Omaha Education Consortium (representing twelve school districts in the Omaha-Council Bluffs metropolitan area, two educational service units, Metropolitan Community College, and Iowa Western Community College), Omaha's Henry Doorly Zoo and Aquarium, Nebraska Department of Education, Nebraska Children and Families Foundation, the Applied Information Management Institute, Beyond School Bells, Streck, UNeMed, Collective for Youth, the Sherwood Foundation, and many more. These partnerships will particularly help to bring STEM professionals already in the workforce into UNO STEM initiatives, helping to educate the future STEM workforce.

7. Collaborations with Higher Education Institutions and Agencies External to the University

In addition to collaborating with colleagues across Nebraska—including faculty at the University of Nebraska Medical Center, University of Nebraska-Lincoln, University of Nebraska at Kearney, as well as at Metropolitan Community College, Nebraska Wesleyan University, Doane College, Creighton University, and other institutions across the state—UNO STEM faculty collaborate with many other higher education institutions across the country and world, as reflected in the publications and grants of UNO STEM faculty. For example, as the lead institution for the Network for Integrating Bioinformatics into Undergraduate Education (NIBLSE, an NSF-funded Research Coordination Network for Undergraduate Biology Education), UNO facilitates communication and collaboration among a network of institutions across the country. Furthermore, UNO STEM faculty are active in national professional organizations, such as the Council on Undergraduate Research. Finally, STEM Faculty routinely collaborate with international colleagues in countries ranked highly on PISA testing, including Finland, for additional initiatives.

8. Contractual Constituencies to be Served

In fall 2017, several members of the STEM faculty conducted market research to investigate the viability of a key component of our proposal—providing contractual services through the Center (e.g. through its NE SciLEAD Consortium office). We concluded that there is an unmet demand for such services and that providing those services will help ensure a robust, sustainable funding model for the STEM TRAIL Center. The only similar entity we identified in Nebraska is Pearson Publishing, who is more engaged with higher education consulting (such as with Metropolitan Community College) than their name implies. Similarly, this industry (i.e., research design and evaluation services) which is predicted to have a 2.1% annual growth (2016–2021), is a $14.6 billion revenue area nationwide. Finally, the barriers to entry into the market are low to medium. The growth is rapid with revenue volatility being categorized highest at "medium." Consequently, we (alongside the unbiased agency, Nebraska Business Development Center) have ensured that this is a viable, sustainable model, even outside of extramural funding long-term (i.e., solely on a contractual basis). Thus, we expect to engage and serve several key stakeholder groups within a contractual environment, including the following:

1. UNO and other University of Nebraska investigators conducting STEM-related research and assessments with undergraduate or graduate students
2. Faculty and other collaborators across the NU system interested in designing and implementing STEM elements of their instruction or outreach work within a context of DBER
3. New tenure-track faculty across the NU System who wish to design and implement a DBER portfolio in their teaching, research, or outreach, with special attention to activities that build toward their tenure-track success
4. Community partners interested in contracting for innovative teaching, research, and outreach projects for P16 students, with special attention to integrating research into the classroom or evaluating research experiences
5. Those regional, national, and international partners interested in contracting with us to provide external evaluation for STEM-related programs, at a significant cost savings to for-profit educational consulting firms

Other models of funding include those replicated at other sites, such as Click2SciencePD and the incubator model of NIH & NSF STTR/SBIR projects.

9. Anticipated Measures of Success

The proposed Center will support numerous existing STEM programs and will provide the infrastructure necessary to support continued growth of STEM teaching, research, and outreach initiatives. Furthermore, as one example of capabilities within the Center, the NE SciLEAD Consortium will provide consulting services in STEM-related design, implementation, evaluation, and assessment, meeting regional and national needs and generating revenue for the Center. Primary measures of success will include the following: 1) increased student recruitment, retention, and graduation in STEM disciplines (as demonstrated in the 4-year pilot of NE STEM 4U with 96% retention to degree and in STEM careers); 2) increased extramural funding for STEM teaching, research, and outreach; 3) further engagement with stakeholders locally, regionally, and nationally; and 4) formal recognition as *the national-level* Center for supporting student research as a pedagogy in STEM areas. Other anticipated outcomes include increases in the number of faculty and staff devoted to interdisciplinary STEM initiatives and in the number and types of mission-directed products and services, including an increase in publications and other methods of disseminating research products (e.g. IP of various kinds, including process patents).

10. Centrality to Role and Mission of the Institution

Foundational to UNO's Metropolitan University mission is the belief that, in order to serve a diverse student body reflective of a dynamic metropolitan region, university faculty must forge meaningful partnerships with community leaders. The UNO STEM Leadership Team clearly demonstrates engaged partnership with community leaders, as represented by its leadership role in the Omaha Citywide STEM Ecosystem and the many collaborative projects currently led by UNO STEM faculty. The proposed STEM TRAIL Center will further advance the UNO mission and reinforce its three overarching strategic goals, as follows:

- **Goal 1, Student Centeredness**—The proposed STEM TRAIL Center will model and implement high-impact practices that have been demonstrated in the literature and recognized by the Association of American Colleges and Universities (AAC&U) and the NSF as being the most effective in preparing students. Specifically, we will offer courses and programs that provide genuine research experiences to students, which aligns with Strategy 1.2, to "*prepare students for academic success, careers, and professional responsibilities in an increasingly complex world (academic programs, advising, co-curricular leadership development opportunities, internships, graduation)*."

- **Goal 2, Academic Excellence**—The new Center will aggressively "*support and enhance faculty and student research and creative activity*" (Strategy 2.3) and will facilitate faculty efforts to "*develop and enhance applied and experiential learning opportunities*" (Strategy 2.5).
- **Goal 3, Community Engagement**—Building on a strong foundation of existing collaborative STEM initiatives, the proposed Center will provide the resources necessary to help "*build new and strengthen existing connections with a broad range of community partners*" (Strategy 3.1), "*prepare students to be engaged citizens and community leaders in a diverse and evolving society*" (Strategy 3.2), "*promote, recognize, and incentivize engaged scholarship*" (Strategy 3.3), and "*fortify rewards and resources supporting engaged teaching and learning*" (Strategy 3.5).
- **Goal 4, Institutional Quality**—By providing the personnel and physical infrastructure necessary to efficiently and effectively support the continued growth of UNO's STEM efforts, the proposed Center will also help the University to "*recruit, retain, and reward outstanding faculty and staff*" (Strategy 4.1), "*prudently manage the financial resources entrusted to us*" (Strategy 4.4), "*increase public awareness of UNO's standing as a premier Metropolitan University*" (Strategy 4.5), and "*maintain and expand facilities to meet the growing needs of the campus*" (Strategy 4.6). Furthermore, the Center's new laboratory facilities will help UNO faculty and students to "*utilize technology that supports learning, effectiveness, and innovation*" (Strategy 4.7).

Finally, the proposed STEM TRAIL Center directly aligns with the original **STEM Priority**, one of UNO's five strategic priority areas (https://www.unomaha.edu/engagement/docs/2012-campus-priorities-2020.pdf).

11. Consistency with the University of Nebraska Strategic Framework

As illustrated by the following examples, the proposed Center also aligns with the University of Nebraska Strategic Framework (version dated 2014–2016, the most current version available on the University of Nebraska website, https://nebraska.edu/strategic-framework.html?redirect=true, at the time of this writing):

- **Goal 1.d** states that the University of Nebraska will "*expand lifelong educational opportunities.*" The STEM TRAIL Center will provide educational pathway opportunities for STEM learning across the P16 pipeline by engaging students and community partners in inquiry-based learning and research activities—in the classroom, in research laboratories, and in informal education settings across the community.
- **Goal 2** states that the University of Nebraska will "*build and sustain undergraduate, graduate, and professional programs of high quality with an emphasis on excellent teaching.*" Using best practices for STEM teaching and learning, as recognized by the AAC&U, we will integrate inquiry-based learning and research experiences into our undergraduate and graduate programs.
- In alignment with **Goal 3**, the proposed Center "*will play a critical role in building a talented, competitive workforce . . . in Nebraska in partnership with state, private sector, and other educational institutions.*" UNO STEM faculty will continue to work closely with business and community leaders in the Omaha STEM Ecosystem and other stakeholders across the state to ensure we provide high-quality STEM programming that prepares students for dynamic and evolving STEM workforce needs across Nebraska.
- In alignment with **Goal 4**, the proposed Center will allow the University to further "*pursue excellence . . . in research and scholarly activity, as well as their application.*" Research as a pedagogy is a core strength of the STEM TRAIL Center, and that research spans teaching, research, and outreach. It may also be a powerful student recruitment tool, especially for exceptionally academically talented students. As a result, this Center will position UNO for continued growth in extramural funding, will support student engagement through that funding, and will lead to increased research and scholarly activity. Furthermore, the Center will "*encourage and support interdisciplinary, intercampus, inter-institutional, and international collaboration.*" We have

existing and close interdisciplinary collaborations across UNO, with colleagues on all University of Nebraska campuses, and with higher education institutions and agencies across the country. We are now ready to build on this foundation to better serve the growing STEM needs of the University, Nebraska, and partners and stakeholders across the U.S.

12. Potential for the Center or Institute to Contribute to STEM Workforce and Economic Development

We expect the contributions of the Center will mirror and expand upon existing projects of the STEM Leadership Team related to STEM workforce development. This Center will work collaboratively with the Omaha STEM Ecosystem and local, state, and regional employers to ensure that we are developing dynamic students that add to local economies. These important partners will also be brought to the table to engage students in internships and other workforce mentoring mechanisms. Furthermore, based on the market research analysis conducted by the Nebraska Business Development Center (NBDC), we believe this Center concept represents a sustainable model with strong economic development potential for businesses, education, industry, and higher education in the areas of educational assessment, STEM Education program and research design, and consultation for best practices related to teaching and research in STEM areas.

13. Consistency with the Comprehensive Statewide Plan for Postsecondary Education

In addition, the proposed STEM TRAIL Center is consistent with Nebraska's Comprehensive Statewide Plan for Postsecondary Education in several ways, including the following:

- **Chapter 3, Meeting the Needs of the State**, states that "*employers need college graduates and trained workers who have extensive and varied knowledge, skills, and demonstrated competencies that prepare them for entering and succeeding in the workforce. To advance in business and succeed in their careers, these graduates also need good oral and written communication skills, . . . teamwork abilities, general workplace skills, and, increasingly, conversancy in more than one language.*" The proposed Center will provide the education and training students need to prepare them to meet the increasing STEM workforce demands in the State of Nebraska. For example, the NE STEM 4U model, developed at UNO and also implemented at UNK and UNL, provides hand-on training for undergraduates in key pre-professional practices—including teaching, research, and mentoring—to help students develop the diverse skills they need to succeed in the workforce. Projects like NE STEM 4U, which are led by UNO and/or developed in close partnership with our colleagues at UNMC, UNL, and/or UNK, provide evidence of the Center's potential to facilitate continued collaboration to implement effective programming that will positively impact postsecondary education in the state. Based on our existing collaborations, we anticipate that our proposed Center will be able to gather letters of support from influential STEM colleagues at all NU campuses, and that it will provide the infrastructure necessary to allow us to continue and expand our synergistic work with our NU colleagues and others colleagues across Nebraska.

- **Chapter 3, Meeting the Needs of the State**, goes on to call out a specific goal to "*contribute to the health and prosperity of the people and to the vitality of the state through research and development efforts, technology transfer…and by attracting external funds to support these activities.*" Moreover, "*…institutions will assess evolving needs and priorities in a timely manner and will be prepared to change and adopt new methods and technologies to address the evolving needs and priorities of the students and people of Nebraska.*" In 2012, the National Research Council established DBER as a field of study to encourage interdisciplinary teams to apply findings and strategies from the cognitive learning sciences to the STEM disciplines in order to improve understanding of student learning in discipline-specific contexts. In the years since, NSF has strategically increased funding for DBER, and the associated research on student retention and

learning clearly demonstrates that research as a pedagogy is a highly effective approach to STEM education that should be offered to each and every student.

- **Chapter 4, Meeting Needs by Building Exemplary Institutions**, describes the need for Nebraska to "*value higher education and support its investment in public higher education through fair and reliable funding policies…*" The funding model outlined above for the new STEM TRAIL Center favors a multi-stakeholder model wherein part of the funding is requested from the state in the form of a legislative priority, with the remainder contributed through extramural dollars (grants and contracts) and/or donations. The multi-stakeholder funding model is to best respect the contributions of each stakeholder and make the best use of dollars. The proposed STEM TRAIL Center, the first and only facility of its kind, would elevate UNO and the State of Nebraska to exemplary status in STEM, regionally and nationally. Our colleagues across Nebraska recognize UNO as a leader in STEM and, as mentioned, we are confident that they will write letters of support to endorse the STEM TRAIL Center at UNO and to acknowledge how they themselves will benefit from the increased NU collaboration that a Center at UNO will help to support.
- **Chapter 5, Meeting Educational Needs through Partnerships and Collaboration**, includes a goal for higher education institutions to "*work as partners with one another and with other entities whenever appropriate to share resources and deliver programs cooperatively to enhance learning opportunities for Nebraska residents*." The proposed Center is founded on the success of UNO STEM's existing partnerships and collaborations, as represented by UNO's leadership role in the Citywide STEM Ecosystem and many ongoing projects of the STEM Leadership Team, as previously described (see parts 6 and 7 above).
- **Chapter 6, Statewide Facilities Plan**, identifies the need for Nebraskans to "*advocate a physical environment for each of its public postsecondary institutions that is supportive of role and mission.*" Currently, the UNO campus does not have sufficient space to accommodate the growth of UNO's STEM initiatives in support of the STEM priority that was established in 2012. This Center proposal respectfully requests innovation in physical facilities that corresponds with a vision for programmatic innovation and that is needed to support our mission-critical work in STEM teaching, research, and outreach.

14. Final Thoughts

We believe that the STEM journey at UNO has been successful primarily because it has been a highly collaborative journey, not only across faculty and disciplines but also across many levels of UNO administration. The vision for this STEM Center is to maintain and to build upon that strong collaboration, particularly through colleges and the community, so as to build upon our greatest strength, the ability to work well together. The faculty members of the STEM Leadership Team are very appreciative for the trajectory of STEM at UNO, which has been strongly supported by individual administrators at all levels. We know that there are many more conversations to have if we move in this direction, including faculty conversations, and administrative input and approvals at many levels, including the Board of Regents. We also fully believe that it is time for this next phase for UNO STEM and for us to work together to conceptualize a STEM TRAIL Center that is fully immersive within the current fabric of UNO excellence while also becoming a bold catalyst to future UNO innovation and our shared vision for UNO becoming the very best STEM program in the country. We think we can get there, if we go there together.

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